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Chairman and Joint Managing Director: G. H. ALABASTER, COMPANION I.E.E.

Technical Editor: C. O. BRETTELLE, M.I.E.E. *Joint Managing Director.* E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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Safety in Electricity.

THE adoption by all supply undertakings of the standard 230-volt alternating-current system for domestic consumers is a consummation devoutly to be wished. Towards this end there are two influences at work: (1) steady pressure by the Electricity Commissioners, particularly in relation to new systems, and (2) lower prices of lamps and apparatus made by mass production for the prescribed voltage.

We have in Great Britain adopted as our standard a voltage higher than those in use in some other countries. This should place us in a distinctly advantageous position for the development of heavier domestic appliances than in, for instance, the U.S.A., where the prevalence of 115 volts or so has proved to be a pronounced handicap to the use of electric cookers.

The use of a relatively high voltage, however, carries with it the attendant disadvantage of increased risk of shock—a disadvantage which, it is true, is off-set to some extent by a reduction of the danger of burns due to the heavier currents at lower voltages.

While serious accidents from shock at 230 volts will doubtless continue to be very few relatively to the large number of people using electricity, we ought not to rest satisfied until we have examined every suggestion that seems to hold promise of making even a slight shock a rare occurrence. The psychological effect of slight shocks cannot be ignored in its possible reactions on electrical development, particularly with regard to the less educated section of the community, to which electrification will probably bring the greatest benefits. This need will become of even greater importance when electricity is taken to the countryside, where conditions are often less favourable to the maintenance of safety and where something of the mystery of an unseen power will for a long time be attached to it in the minds of users. Even in towns any accident that may be attributed, reasonably or unreasonably, to electricity is still—after all these years—seized upon by the lay Press as sensational news.

Thus it is that, while the general use of a voltage lower than 230 would seriously hamper electrical development, refusal to face the facts regarding its possible drawbacks will have a similar result.

The use of electricity in factories and workshops is

governed by regulations laid down by the Home Office. Although accidents due to electricity do occur in those places, it is some satisfaction to note that they do not increase anything like proportionately to the growth of electrification, and there can be no doubt that accidents due to other causes are at the same time very much more than proportionately reduced. This is no doubt in part due to an efficient system of inspection. The Home Office regulations with their corollary of inspection do not, of course, apply to residential premises, but as the kitchen, for instance, is often a kind of workshop, there is a distinct moral obligation that the electrical installation, and its maintenance, should receive at least equal care.

It has been said that increased risk is the price we pay for progress, but this is not necessarily so, as will be obvious from a consideration of the greater dangers attending the use of other means of obtaining light, heat, and power, which electricity is superseding. Nevertheless, "safety *first*" is not an inspiring slogan, and never was at the back of any pioneering achievement; its too literal acceptance would have prevented the development of aviation and motoring and would have destroyed the spirit of adventure in which man triumphs over his natural environment. Yet the possibility of ensuring 100 per cent. safety should certainly be considered as of great importance, provided the price to be paid for it is not too high.

In an article now running through our pages MR. T. C. GILBERT makes a suggestion which investigations abroad have led him to believe would secure as nearly complete safety from electric shock as possible. In leading up to his constructive proposal, he summarises opinions regarding dangerous voltages collected from many countries; he also criticises the methods at present in force for reducing danger. It should be borne in mind, however, that this epitome is related to an ideal safety and must in no way be held to reflect on the safety of electricity as compared with its rivals. We believe his remarks will be of interest to all interested in the progress of electricity, and we hope they will initiate a fruitful discussion.

Service Again!

WHAT *do* we mean by service? We *know* something that somebody else wants to know and we tell him. He is satisfied—even pleased. That is a service rendered.

We can *do* in a moment with always-ready tools or equipment something that somebody else can't possibly do for himself or herself. We do it! Much trouble and vexation are avoided. That again is service—a real service. It makes a Satisfied Consumer—a friend who will speak well of us and of those we represent. That testimonial ultimately converts into money—multiply it a thousandfold and we have a successful undertaking or other enterprise, *i.e.*, bigger dividends or more money for rate reduction!

Some say that we are conspicuous for our shortcomings as a people in this matter of electrical service. They ask "What do they know of service who only England know?" and emissaries accordingly visit the land that has never been handicapped electrically, but has always had a free hand and a full incentive to get "right there." Here we have known about service a very long time—that is, the theory of it. There they have applied it without the example of a progressive gas commercialising spirit. Roughly speaking, they have no illuminating gas there! Here we have plenty of it—always have had—more than enough! This should make us see the greater necessity for expert and efficient service here than there. But somehow if we see it we don't seem to rise to the occasion. Yet, strangely enough, here with plenty of gas competition we are making great strides with electric fires and electric cookers, while there—well, they refrigerate electrically and hobnob with the vacuum cleaner, but warm themselves and cook their courses non-electrically. Soon we may expect a deputation of transatlantic cousins to investigate our methods of selling myriads of electric fires and many thousands of cookers every year.

MR. H. T. YOUNG told the last E.D.A. salesmanship conference that there were 350 American electricity supply companies with Home Service Departments run by women, and there will be many who will endorse his statement that a great deal more could be done in that direction here. Indeed, there can be no question about it. We talked about this sort of thing long before they did much of it in the States, as the back numbers of the ELECTRICAL REVIEW amply demonstrate. Why don't we do less of the talking and get on with the job? There are areas and boroughs where undertakers and their officials have long been well to the fore in this matter. Go ahead engineers, courageous enough to lead the way, have been regarded as reckless zealots because they have so acted as to secure the strong backing of their employers. But other managers and engineers have looked with envy upon the latitude that these have been accorded by their Councils while they have been obliged to live the life of caged birds. Our service efforts are on a scale totally disproportionate to the importance and potentialities of the industry, yet there are plenty of electrical women nowadays who know how to win their way with women, and who matters so much as they do? What the electricity supply industry lacks is the electrical equivalent of a Gas Goodenough.

Electrical Exports in 1929.

RATHER late in the year, but still earlier than usual, the statistics relating to Great Britain's export trade during 1929 are now available. They analyse the distribution of the trade among the various markets, and from them we have prepared a table showing our electrical exports during the year. In spite of the fact that there was a fall in price levels, the total value of these exports exceeded that of the preceding year by about £1,200,000. This was attributable entirely to electrical goods and apparatus, shipments of which rose in value by £1,530,000; there was a decline of about £340,000 in machinery exports.

So far as the goods and apparatus class was concerned, Empire countries took well over half and these countries and foreign customers increased their shares to approximately the same extent. It will be observed that Argentina proved to be our largest foreign customer with Italy and Spain a long way behind; the latter country, however, trebled its share of the trade by purchasing considerably greater quantities of telegraph and telephone cable from us. All of the principal Empire markets, with the exception of Ceylon, were better customers for electrical goods last year. Australia heads the list, being credited with about a third of the total, while India took second place with over a fifth of the total. Cables were responsible for the increase in the Australian and Indian figures.

The machinery class (which includes transformers, convertors, switchgear, &c.) showed a general decline, the three exceptions being d.c. motors, control and switchgear, and unspecified machinery. The decline in the share of foreign countries, roughly a third of the total, was not so severe as that in the Empire countries' share. There were fairly substantial rises in the values of a.c. motors shipped to Empire countries and control and switchgear sent to foreign countries.

It is fair to say that the electrical export position was not radically altered during 1929, although two tendencies are perhaps discernible. One is an increase in exports of goods and apparatus coupled with a fall in machinery shipments, and the other is greater progress in trade with foreign countries than with countries in the Empire, to which we look for the greater part of our business. During the first nine months of the current year the latter tendency appears to have continued; on the other hand, while machinery exports have risen, electrical goods and apparatus have been lower than they were in 1929.

Boiler Service.

THE meeting of the London Technical Group of the Electrical Power Engineers' Association on October 28th was a good start for the 1930-31 session, and the paper presented by MR. G. A. PLUMMER on the "Progress and Development of Steam Generators for Electrical Power Purposes," and the subsequent discussion, abstracted elsewhere in this issue, indicated the increasing usefulness of the Groups.

Mr. Plummer visualises for the future the steam generator, working at much increased pressure and temperature, which will only be taken off the range for annual cleaning and inspection; "it will probably be fired with smokeless de-sulphurised fuel, and will consume its own grit in a special combustion chamber."

This is very optimistic, but that it may be not unduly so is supported by a remark during the discussion by Mr. H. E. Partridge to the effect that last year he had seen in the U.S.A. 260,000-lb. boilers which were blown down only once every six months. The problem represented is, of course, one of maintenance, and it bears particularly on the question of water treatment. The continuous working period of a boiler depends to a very large degree on how long the internal parts can be kept comparatively free from corrosion and incrustation.

Long periods of service from boilers are becoming more and more necessary, and under the grid conditions they will be essential. The water-treatment problem, then, is very important and urgent, and it offers a field for research co-operatively for the supply man and the manufacturer.

Further, the question of maintenance also depends to a great extent on the external heating surface, which must be kept comparatively free from slagging. In this connection there is probably much room for improvement in pulverised-fuel boilers; although we hear nowadays of the slagging troubles being overcome, it is doubtful whether they have been eliminated to such an extent as to permit twelve-month working periods.

Much also depends on the ability of boiler materials to stand up to modern requirements of high pressures and temperatures, and it is very encouraging to learn from Mr. Plummer that the near future is likely to see a solution of this problem.

The E.D.A. Directorship.

WE have not alluded further to this subject since the publication of our leading article, "Where is he?" on October 10th, and our leaderette directing attention to the advertisement of the vacancy in our issue of October 17th. Our silence has not meant that we had nothing further to say, but that, having given expression to our convictions, we thought the correct course was not to handicap the Executive Committee while it had the applications before it. Perhaps it might have been as well if others had done the same. We may now say that our views received support from many directions, and a number of names were sent to us, but these we have not felt it to be our duty to pass on. Even now we have no intention to comment further upon the appointment, but when we find our generally sane contemporary, the *Electrical Contractor*, official organ of the Electrical Contractors' Association, taking so deplorably conservative an attitude as is set up in its November issue, we must record our astonishment. Mark the following: "Ultimately we may achieve the united support and vigour postulated by the suggestions put forward by the ELECTRICAL REVIEW. *But, as we believe, the time is not yet.*" The writer goes on to say we cannot afford this, we do not want that—what we must do is to "*look forward to a few more years of steady spade work designed to consolidate and advance, little by little, the position already won.*" Well! Well!!

Spade work has been going on for many years—let us lean on our spade a little longer turning over the sod bit by bit instead of throwing in all the strength and power of an expertly guided electric plough!

Our own view, and that of many others, is that, given "adequate propaganda," we could bring into the next three years the work which at the present rate will occupy six, as SIR J. R. BROOKE advocated to the Batti-Wallahs. No! says our contemporary. Let us go on as we are going! A few more years shall roll, a few more campaigns come, and then—*then* the time for something big may arrive! Can it be that putting things off until to-morrow is the authorised policy of the Contractors? We *will* not, *cannot* believe it!

Even if the writer does claim to be voicing the view of the organised contractors, it should be recognised that they form but one section of the contributors to the fund. Writing, we believe, as the organ of the whole electrical industry—not of one section only—we claim that *we* (the industry) *can* afford it, and *ought* to do so, without waiting a few more years. Did such lukewarm enthusiasm as our contemporary displays ever inspire any great forward movement?

Electricity Supply in West Ham.

ON a later page is given an account of the 30,000-kW extension at West Ham, whose design was the last important piece of work carried out by MR. F. W. PURSE in municipal service. West Ham shares with Bradford the distinction of having the largest turbo-alternator in Great Britain to run at 3,000 r.p.m. Incidentally, we recollect recording that the 10,000-kW set put into commission in 1922 was among the first to be installed of that capacity at the same speed—a matter of interest as registering growth of capacity in relation to maximum r.p.m. at 50 cycles, bearing in mind that before the war 3,000 kW represented the greatest advance in this direction. Since then three similar sets have been added, bringing the total capacity to 76,500 kW, a contrast to the initial installation of 675 kW in 1898 at Abbey Mills power station. A hint of progress in another direction may be found in a report of the electrical engineer at that time, wherein he refers to his staff of one *fully qualified* assistant in receipt of a remuneration of £1 per week.

Canning Town is, of course, a "selected" station, and will be connected to the grid by two 66-kV 0.25 sq. in. cables to Barking and by one similar cable to Poplar. Two banks of 20,000 kVA, 66/6.6 kV (2-phase) transformers are to be installed.

The annual output of the undertaking is now close on a hundred million kWh. The really important matter is how this output is used, and it is here that a glimpse is obtained of the difficulty that confronts MR. JAMES TOWNLEY, the engineer and manager. About one-eighth of the output is sold to domestic consumers. The population of the area served is just over 300,000 persons, who are housed in 52,000 residences, of which 42,500 have a rateable value of less than £17—a very large proportion being less than £12—and all occupied by two families. These conditions do not provide a very promising field for electrical development. However, the successive engineers have been men of a courageous type, and in 1927 the Council approved a scheme for laying mains in every street, which followed the adoption of a rental wiring scheme in 1925. Under these schemes some 80 miles of distributors have been laid, leaving a further 60 miles to be laid before electricity is everywhere available. The rental wiring scheme has proved highly popular, and up to date 7,500 houses have been wired by the undertaking's own staff, the present rate of progress being about 250 houses per month. While the revenue per consumer from such property may be small, the premises are relatively close together, so that the total return per mile of distributor should not be very different from that received from better class property. It is a good augury for the future that many rental wiring consumers are using the smaller types of domestic appliances, such as irons, kettles, and bowl fires, since the effect will be to instil into the coming generation the desire for electrically equipped homes.

A further point worthy of mention is that a number of electric clocks are working in the borough direct off the supply mains and keeping accurate time. These do not yield much revenue to the undertaking, it is true, but they provide a good medium for advertising the fact that electricity can do things that its competitors cannot.

The West Ham Extension.

The 30,000-kW extension of the generating station and the new offices and showroom were officially inaugurated on November 7th.

THE outstanding feature of the latest extension to the West Ham power station is that at the time of its installation, in the early part of this year, the 30,000-kW (m.c.r.) turbo-alternator was the largest machine in Great Britain to run at 3,000 r.p.m.

The new set, of the English Electric Company's manufacture, is of the multi-cylinder type with one h.p. (impulse) cylinder and two l.p. (reaction) cylinders in tandem. It will be seen from the illustration in fig. 2 that the new set's 69 ft. of lean length lies parallel with and close to the switchboard, too close for the comfort of the attendants, one would suppose. However, that will be remedied as soon as the switchgear has been transferred to the switch-house, now in course of construction.

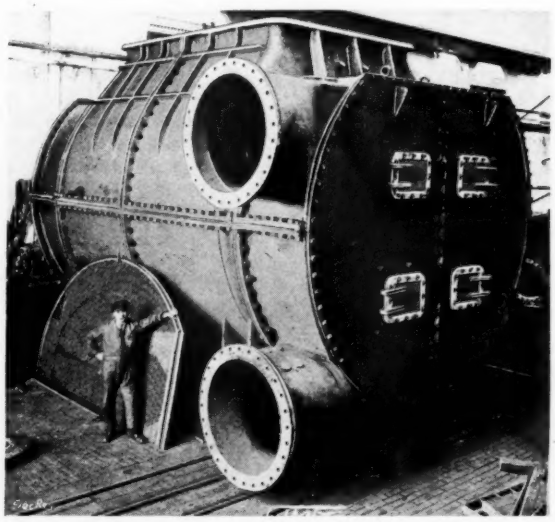


Fig. 1.—Condenser during Construction.

The steam conditions are 200 lb. per sq. in. and 750 deg. F. Steam enters the high-pressure cylinder by way of two 14-in. diameter pipes from the boiler house, a separator, a main stop-valve, and mechanically interlinked twin throttle valves controlled by an oil-relay governor, and passes from this cylinder to the first low-pressure cylinder through two overhead pipes, and to the second low-pressure cylinder through pipes underneath the turbine floor. The emergency governor, of the out-of-balance ring type, is mounted on the turbine shaft. The steam end of the set was illustrated in these pages earlier in the year.* In the two low-pressure cylinders steam flows from the outer ends towards the centre, where a single exhaust opening communicates with the condenser, see fig. 3. This arrangement, together with a double Michell thrust adjustment bearing between the two rotors, provides for axial balance and end thrust.

The alternator, which is rated at 37,500 kVA, generates two-phase current at a pressure of 6,600 V, 50 cycles. It is ventilated on the closed-circuit system by means of a 400-h.p. motor-driven fan and a Heenan and Froude cooler. The heaviest individual portion of the set is the alternator stator, which weighs 77.5 tons; the rotor weighs 25 tons and measures 21 ft. between bearings. The machine is controlled by a motor-operated oil circuit breaker with a rupturing capacity of 750,000 kVA supplied by the British Thomson-Houston Co., Ltd., which company is also completely replacing the main e.h.p. switchgear.

The single-shell condenser, fig. 1, with its cooling surface of 28,000 sq. ft., is one of the largest installed in this country, and was also constructed by the English Electric Co., Ltd. It operates in conjunction with two

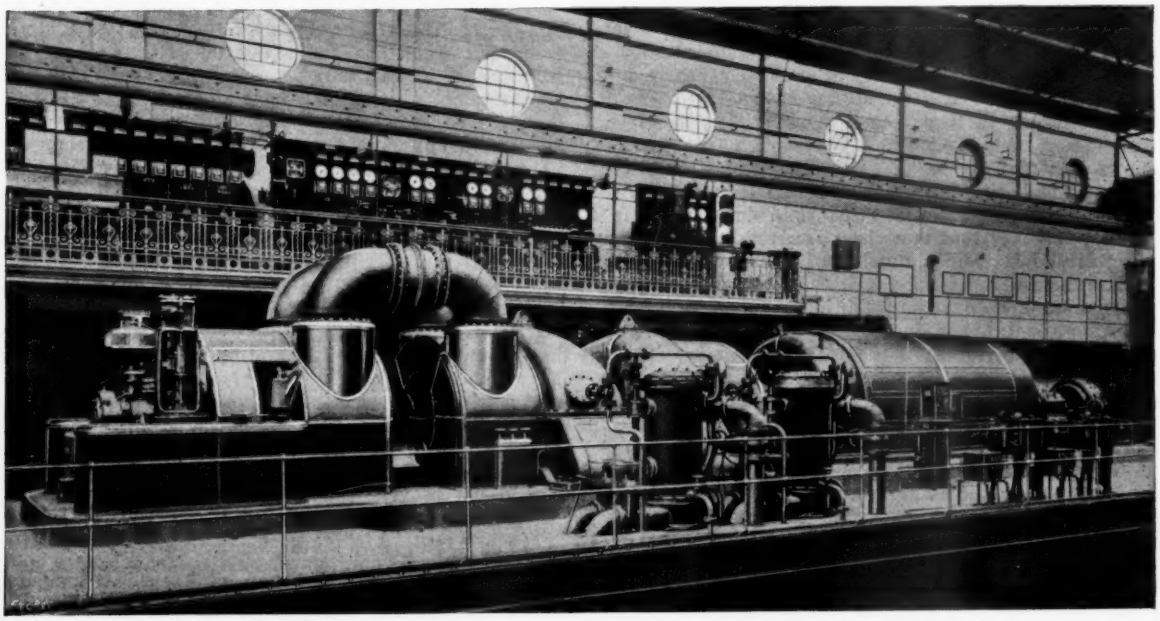


Fig. 2.—General View of the New 30,000-kW, 3,000-r.p.m., Turbo-alternator.

* Electrical Review, February 21st, 1930.

cooling towers, each of a capacity of 430,000 gal. per hour, installed by the Davenport Engineering Co., Ltd., and is designed to maintain a vacuum of 28.3 in. Hg. (bar. 30 in.) when supplied with cooling water at 75 deg. F. The condensation of 282,000 lb. of steam per hour necessitates the use of over 2,000,000 gal. of circulating water, which is provided by two vertical-spindle centrifugal pumps driven by 460-h.p., 400-V induction motors.

The duplicate two-stage Mirrlees-Watson air extractors are shown in the foreground of fig. 2; the condensate is withdrawn by duplicate vertical-spindle two-stage pumps. Two-stage bleeding is employed with a drip cooler; the maximum feed temperature when passed back to the boiler feed pumps is 227 deg. F. The extension to the boiler plant comprises the two steel-clad tri-drum Stirling boilers shown in fig. 4. Each boiler is capable of a maximum evaporation of 177,000 lb. per hour (normal 147,500), and has a heating surface of 17,300 sq. ft. exclusive of the water walls and front screen. The working pressure is 230 lb. per sq. in. The superheater, which is installed between the first and second banks of main tubes, is designed to raise the total temperature to 780 deg. F.

A special feature of the design of this boiler is the introduction of a patent front wall screen consisting of a lower header and three rows of circulating tubes. The installation of this front screen dispenses with the ordinary type of refractory wall, and it is expected that maintenance costs will be thereby reduced. Water walls are fitted to each side of the combustion chamber. Each mechanical stoker, of the Underfeed Stoker Co.'s "L" type, has a total grate area of 528 sq ft., capable of burning 10 tons of coal per hour. Suspended arches of the Detrick type are provided at both ends of the stoker.

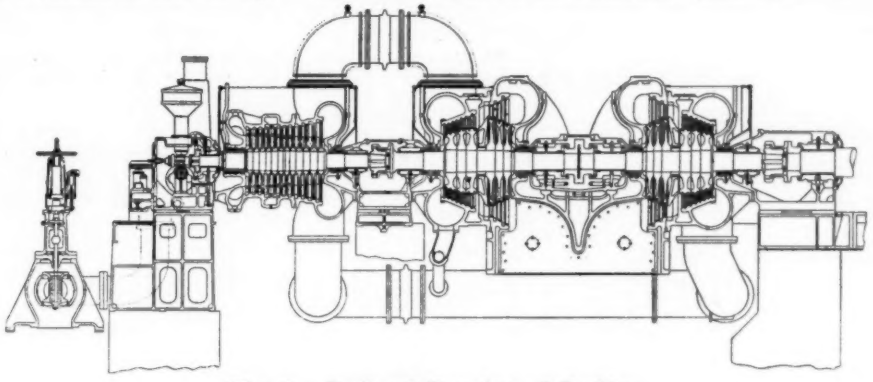


Fig. 3.—Sectional Drawing of Turbine.

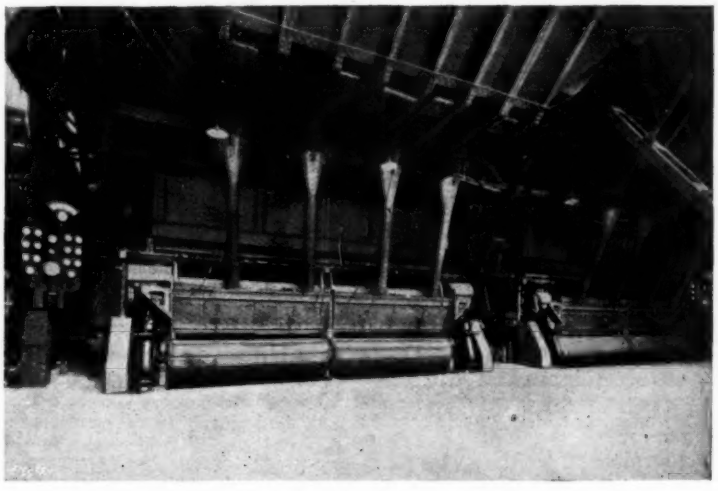


Fig. 4.—Front View of the New Boilers.

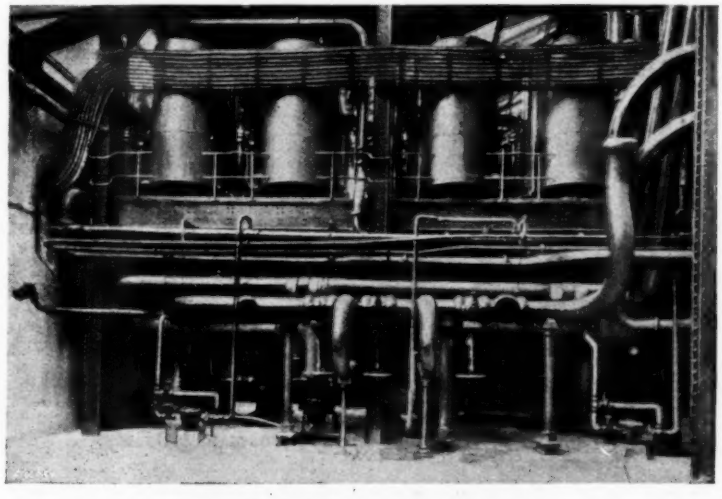


Fig. 5.—The Evaporating Plant.

The boiler drums are suspended from overhead beams, which form a separate floor for carrying the economiser, air heater, induced-draught plant, &c., the ordinary framing members being dispensed with. The tri-tube cast-iron economiser of Messrs. Green & Son's manufacture has a total heating surface of 7,930 sq. ft. The Stirling air heater is of the tubular type, with a total surface of 28,702 sq. ft. The flue gases pass to the chimney, which is 10 ft. in diameter by 138 ft. from the firing-floor level, by way of the economiser, soot hopper, and air heater. Alternatively, they can be by-passed direct to the chimney. The sequence can be followed by reference to fig. 6.

Each boiler is equipped with a 22-point "Diamond" soot blower. The whole of the boiler mountings are of Messrs. Hopkinson's manufacture. Each boiler unit has its own instrument panel, upon which are mounted a "Kent" flow meter, CO_2 indicating and recording instruments, draught gauges for air pressure and gas, "Cambridge" distance thermometers for reading steam temperatures at the superheater outlet, and gauges for indicating pressures at the economiser inlet and outlet, and the steam-pressure.

Two steam- and one electrically-driven feed pumps have been installed; the duty of each is 33,000 gal. per hour at a pressure of 335 lb. per sq. in. Two sets of triple-effect 3,000-gal. per hour evaporators of Weir & Co.'s manufacture, illustrated in fig. 5, supply distilled make-up water to the boilers from the River Lea, which is somewhat turbid at this point. These evaporators are operated with high-pressure steam and also with exhaust steam from the feed pumps.

The new buildings, which are of steel-frame construc-

tion, with corrugated-iron sheetings, were supplied by the Stirling Boiler Co., Ltd.

The whole of the plant described (costing approximately £320,000) was installed in accordance with the scheme, plans, and specifications prepared by Mr. F. W.

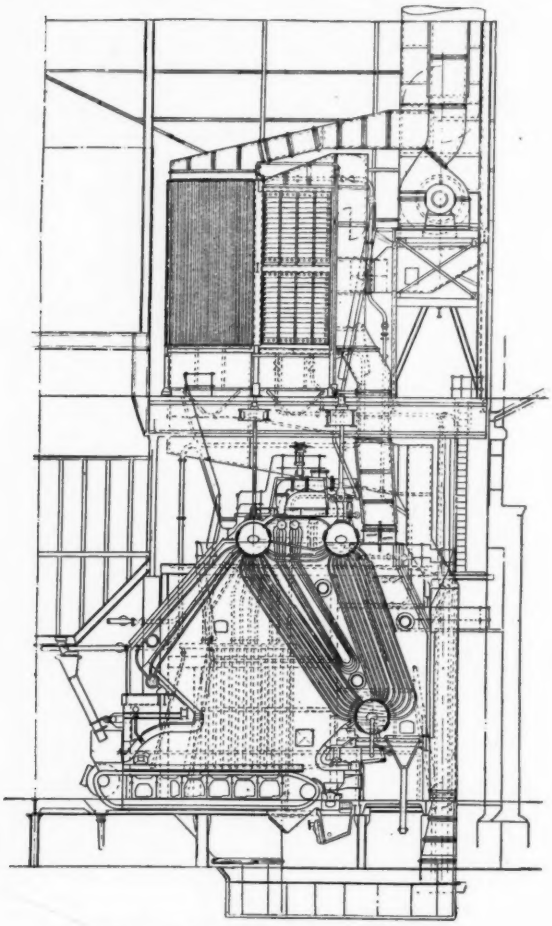


Fig. 6.—Cross Elevation of Boilers.

Purse, M.I.E.E., M.I.Mech.E., the former electrical engineer and manager of the West Ham undertaking.

After the ceremony at the power station, another official inauguration took place. That was at the new office building, an imposing edifice (shown in fig. 7) of multi-coloured brick, with Portland stone base and dressings, which has frontages of 129 ft. in Romford Road and 293 ft. in Vicarage Lane. At first glance, wonder might be expressed that the staff, even with the many activities associated with the West Ham undertaking, should require so much accommodation. Things are not always what they seem, however, and closer inspection reveals that the building has been cleverly designed by the borough engineer and surveyor, Mr. W. L. Jenkins, for effective appearance and efficient utilisation of space and natural light. In reality the building is L-shaped and, as regards depth, consists of a corridor and one office only. In the angle are situated the various stores and outbuildings that are generally best out of sight. The showroom, where accounts and local rates may be paid, is adjacent to the entrance hall and provides an attractive display without appearing too grand for people of small means, who form the bulk of the consumers in West Ham. Meals for the staff are cooked in a model electric kitchen, which will also serve the purpose of continuously demonstrating to visitors the operation of kitchen equipment of various types. The building is, of course, heated throughout by electricity. Electric fires are installed in the offices, but the basic heat is provided by hot water derived from a calorifier and storage vessel located in the basement. Low-voltage thermostatically-controlled immersion heaters made by Messrs. A. Reyrolle & Co., Ltd., are used; these consist of four banks, comprising nine 3½-kW units each, making the aggregate loading 120 kW. The main contractors for the building, which cost £60,000, were Messrs. A. E. Symes, Ltd.

Our thanks are due to Mr. J. W. J. Townley, A.M.I.E.E., engineer and manager of West Ham Electricity Department, for information supplied in connection with the preparation of this article.

The Inauguration Ceremony.

The proceedings were opened by the presentation of baskets of flowers to Mrs. Herbert Morrison, the Mayoress (Councillor Mrs. A. J. Hollins), and Mrs. W. J. Reed by Councillor Mrs. E. J. Gregory, Miss Reed, and Miss Townley, respectively. Ald. W. J. Reed (chairman, Electricity Committee) gave with the aid of a microphone a brief history of the undertaking, and described the main features of the new plant. The Minister of Transport (Mr. Herbert Morrison, M.P.) found himself unable to compete vocally with the noise of the generators, and wisely decided to defer his speech—the only part of the proceedings not entirely in accordance with the programme. He confined his efforts at that point to unveiling a tablet on the 30,000-kW alternator on which was inscribed the name "Elizabeth Reed," and then setting the turbine in motion. The large party, which included a number of well-known engineers, was then conveyed to the new offices, where the Minister traced the history of the undertaking from 1895 when it started with gas-engine plant; the next stage was the opening of the Abbey Mills station in 1898, which was superseded by Canning Town in 1904. Progress, he said, had been continuous until to-day 76,500 kW of plant was installed. The policy adopted by West Ham Corporation of laying mains in every street, and in anticipation of requirements, was one he would like to see followed everywhere. Speaking as the owner of an all-electric house, he expressed great faith in the benefits electricity would bring to the home. Electrical development would also help the country's economic progress and provide useful employment. He had no patience with undertakings which charged high rates in order to earn quick and substantial profits. He doubted whether local authority areas would prove the most suitable distribution areas, and suggested that an alternative method provided a problem for the future.

The Mayor (Alderman J. H. Hollins, J.P.) presented a souvenir to the Minister in the form of an electric table lamp. The vote of thanks to the Minister was proposed by Ald. G. Groot, J.P., and seconded by Councillor Mrs. E. J. Gregory.

Fig. 7.—The Recently-opened Showroom and Offices.

The borough engineer (Mr. W. L. Jenkins) presented a key to the Mayor, and after a short address by Ald. Reed (in which he stated that the office furniture had cost £3,500, all of which, except £46, had been spent in this country), the Mayor declared the building open, and invited those present to inspect the showroom and offices.

Prevention of Accidents.

A further criticism of present installation methods. Introductory remarks regarding an alternative system which is claimed to meet the requirements of safety.

By T. C. GILBERT, A.M.I.E.E.

(*Continued from page 774.*)

Regarding essential (*a*) the failure of main earth connections is too common to question; the great danger here is that not only is a dangerous potential impressed upon a faulty appliance in this event, but also on all other appliances connected to the same earth circuit, although these appliances may be sound in themselves. Fig. 1. illustrates this condition, which often exists unsuspected, and it will be obvious that, if an earth fault exists in appliance A, it would have been safer to have left appliances B and C unearthed, as, owing to the breaking of the earth wire at X, the full line voltage is also present in their earthed casings.

There is no quick and easy way of ensuring that this main earth connection is intact. A plain continuity test is almost useless, although better than nothing; we do not want to know its resistance, but we do want to be

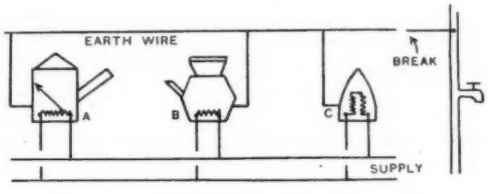


Fig. 1.—Failure of Earth Connection.

able to assure ourselves that it is good for 50 amperes, or more, at a moment's notice. We will call this " Fault W " when referring to it later.

Regarding essential (*b*), where conduit is of the heavy gauge screwed variety, continuity sufficient for good earthing may be practically guaranteed, but this can apply to no other system. With the many lead-covered wiring systems at present in use, it is the exception rather than the rule to find continuity, not of low-enough resistance, which is easily accomplished, but really sound continuity that will deal with heavy fault currents without over-heating and introducing resistance.

That this is a fairly sweeping statement I am well aware, but this opinion is backed by some of the foremost consultants and engineers in the country, and it is to-day generally recognised that earthing, to be really efficient and to possess any protection value, cannot be effected by the flimsy metal-clad wiring systems now so much in vogue, again generally on the score of cheapness.

The 1929 Factory Report is also very disturbing upon the question of 3-pin plugs, and it was in consequence of serious trouble experienced in those accessories that the experiments in low-voltage working (mentioned last week) were undertaken. Whilst it should be possible to perfect an article which will give three simultaneous good contacts, it is obvious from the above that reliance can hardly be placed upon some of the patterns of 3-pin plugs and sockets at present on the market, so that the question of unreliability of the earth circuit is immeasurably increased. This will be referred to later as " Fault X."

There is, however, no need to stress the unreliability of ordinary earthing methods, as this point is only too familiar to all electrical engineers; we are rather more concerned to know that, even when existent, earthing does not fully protect us, but in fact introduces new dangers. With ordinary earthing methods the circuit fuse cannot blow until the fault current has reached a high value, and the faulty apparatus a high potential, depending upon the resistance of the earth connections. For instance, even should the total resistance of the main earth connection plus the conduit or other sheath resistance not exceed the maximum laid down by the Institution of Electrical Engineers Wiring Regulations, *viz.*, 2 ohms, yet in the case of a radiator or other appliance connected to a circuit protected by a 25-ampere fuse a high potential will be present on the framework of the appliance immediately prior to the blowing of the fuse. Assuming this fuse to blow at 50 amperes, this potential will reach the value of 100 volts.

This potential would probably be of too short a duration to present any real menace to a healthy person, but the case is quite different under conditions where the circuit fuse is not correctly adjusted. In the instance mentioned above, should the fuse be negligently replaced, and require 150 amperes to melt it, then obviously, with an earth circuit resistance of 2 ohms, it can never blow, and the dangerous potential may remain upon the casing of the appliance indefinitely.

The same state of affairs can exist, even when the circuit fuse is correct, in cases where the earth circuit, the fault itself, or the two together, possess a resistance sufficiently high to prevent the passage of a current heavy enough to melt the fuse. It is commonly found that a fault is not " dead " to the appliance casing, but may possess considerable resistance, if occurring, for instance, in the middle of a heating element. In this case the circuit fuse will stand the overload for a length of time depending upon the magnitude of the leakage current and the overload capacity of the fuse; but should the resistance in the earth circuit be due to too small or bad connections, then this fault current will almost certainly destroy them after causing serious overheating with a consequent further rise in resistance. This will, of course, reintroduce " Fault W."

In view of the ease with which circuit fuses can be tampered with and the liability of too large a fuse being inserted to avoid inconvenience, this constitutes a serious menace in any installation dependent upon earthing for protection, and will be referred to later as " Fault Y." It is interesting to note that the use of fuses of too high a rating is punishable by law in Norway.

Earthing also introduces further risks of its own. In the case of radiators or cookers with open type elements, toasters, artificial sunlight apparatus, the ubiquitous bowl-fire—in fact in any appliance where its metallic casing does not constitute a complete earth shield over the element, then it is always possible to obtain a shock under normal conditions of use. Fatalities have occurred from this cause, and also in several cases where shocks have been received from one article possessing an earth fault being handled simultaneously with other

earthed apparatus. Whilst accidents are probably less likely for this reason than for any of the other reasons mentioned above, yet the risk is sufficiently great to call the possibility " Fault Z."

Possibly the greatest criticism that can be levelled against earthing as a safety measure, beyond its unreliability, is the fact that it is practically useless in rural areas. In these situations, where *greater* protection and not less is required, seeing that we have to protect our cattle as well as our personnel, it is almost impossible to obtain earth connections possessing sufficiently low resistance to be effective. In the course of tests made with single and multiple tubular earths of the type now usually utilised as being more efficient than earth plates, it was found that the resistance varied from 12 to 148 ohms, depending upon the nature of the soil, whether wet or dry, and the space between the tubes. In many cases, following dry weather, much higher resistance figures were indicated. It is thus clear that in rural areas, where no public water supply is available, it may be quite impossible to fulfil our essential (*a*) for good earthing, that of a low-resistance earth connection. In such districts protection for the electrical apparatus user is sought by connecting the metal casing of such apparatus to the neutral wire of the supply, and earthing, as such, abandoned.

In order to get over some of these drawbacks of earthing, several unorthodox wiring schemes have been introduced, but it is doubtful if these achieve their object very successfully, seeing that they introduce further defects of their own. There is, however, no opportunity to discuss such systems in this necessarily brief survey of the general position, especially as those schemes have made very little headway, representing as they do mainly a reversion to very early practice.

Finally, whereas earthing may represent a fair safety measure when applied with due care to fixed apparatus, it can have no comparable value for portable apparatus for the reasons mentioned, for which protection is the more essential.

Protection by Connection to Neutral.

In this method of protection the outer casing of all apparatus is directly connected to the neutral wire of the supply; this wire is usually very little above zero potential, although in the case of faults or severe out of balance loads, the neutral potential can rise to a considerable value, depending upon the length of the line, the magnitude of the out of balance or fault current, and the value of the earthing resistance at the substation. Yet all the criticisms that have been advanced

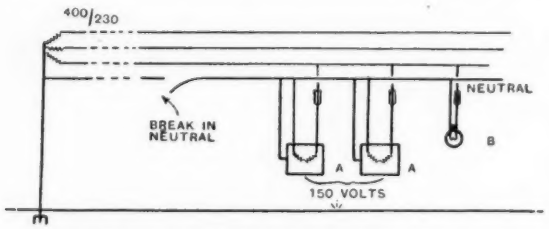


Fig. 2.—Effect of Break in Neutral.

against earthing can, with equal justice, be advanced against protection by connection to the neutral, which, for the want of a better word, will be hereinafter referred to as " neutralisation." In addition, there are one or two further shortcomings, peculiar to the districts in which neutralisation is generally employed.

In large installations, possessing their own substations and their own internal distribution schemes without overhead lines, neutralisation is probably quite as effective for protection as earthing, if not more so, seeing that every particle of metal in the construction of the building can be bonded and neutralised. The possibility of shock is thus rendered fairly remote, except under conditions similar to faults " X " and " Y," and in the case of fault " Z " possibly slightly increased.

When introduced into rural areas, however, where probably long overhead lines may be utilised, neutralisation possesses some very alarming possibilities of danger. It is very difficult to ensure that somewhere in the long neutral, with its many connections between the sub-station and the appliance, a disconnection may not take place. Should this happen, *all* apparatus connected to the end of the neutral remote from the supply will at once obtain a dangerous potential, together with the neutral wire itself, as soon as *one* lamp or *one* piece of apparatus is switched on in that area. This will be clear from fig. 2.

If we assume that the resistance of the 100-watt lamp, switched on, is 500 ohms and that the resistance of the human body be 1,000 ohms, then a person touching either of the appliances shown will receive a voltage of about 150 volts, neglecting the earthing resistance at the transformer station.

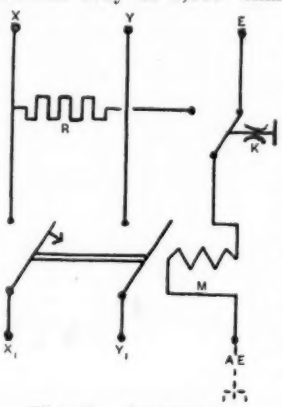


Fig. 3.—Automatic Isolating Switch.

This state of affairs can also be brought about by the simple breakage of the neutral overhead line, even should it fall clear of the phase wires; should it fall on to a phase wire, then similarly dangerous conditions will arise, together with other complications which, being irrelevant to our subject, need not be gone into here. This whole question is very fully discussed in a recently published booklet entitled " Rural Electrification," by Alfred Ekstrom, D.Sc., M.I.E.E. and Vidar Ekstrom, C.E., to which the interested reader is referred. In this booklet are explained the several ways in which undesirable potentials may appear upon consumers' apparatus—as, for instance, by unbalanced 3-phase loads, where neutralisation is employed—with a completeness unfortunately impossible in an article such as this.

Even should the end of the broken neutral line fall to the ground and become earthed at a fairly low resistance, say between 5 and 10 ohms, an undesirable potential may still be present upon all connected consumers' appliances in the event of an unbalanced load, this potential depending upon the magnitude of the out of balance current and the earthing resistance at the transformer station.

Neutralisation appears to be so doubtful a " safety " measure that it should never be contemplated unless earthing, with all its defects, is quite impossible, or unless certain further protective measures can be instituted. These could be either (*a*) the duplication of all neutral lines or wires, not only inside but outside consumers' installations, or (*b*) some form of protective switching employed, which will be more fully described in a later article. The principle of this safety switching, which is very fully employed on the Continent, is also called " artificial earthing."

The use of such switches and relays on the consumer's own installation will protect him against all the above-mentioned dangers of neutralisation, or of earthing, and will be considered as fully as possible within the scope of a general survey such as this.

Protection by " Artificial Earthing " or Safety Switching.

Protection by this means consists essentially in the operation of a circuit-breaker by means of a leakage current, whereby the supply is immediately cut off from the circuit affected as soon as a potential likely to be dangerous appears upon the protected apparatus.

At first glance this might seem to be very similar to earthing, which it is, but with the following important differences: first, the actual current required to operate the switch is very small; secondly, the earth circuit and main earth connection may possess a high resistance—up to several hundred ohms—without in any way affect-

ing the operation of the device; and thirdly, the potential upon the protected apparatus cannot rise to a dangerous value. It will be remembered that these three points are diametrically opposite to the conditions prevailing with earthing.

As there is no apparatus manufactured in this country suitable for artificial earthing, or safety switching, so far as I have been able to discover, I have been forced to carry out tests and investigations with apparatus produced upon the Continent. Of the many types of safety switch in use in Germany, I have come to the conclusion that the " Sbik " automatic switches are by far the best of their kind, and these will be described as fully as possible within the limits of this article. Only two types will be considered, both of which are suitable for the particular installations under discussion, the domestic and the rural, although many other types are available to meet practically any demand.

The arrangement of this switch in its very simplest form is shown in fig. 3. This particular pattern is designed for use in connection with existing main switches and fuses, or circuit breakers, being a leakage-current protective device only.

The supply enters by X and Y, whilst the terminal AE is connected to any sort of earth, such as internal steelwork, hot-water systems, earth-tubes, it being unnecessary to ensure that this connection is of low resistance. The circuit-breaker portion of the switch can be operated either by hand or by the current-leakage coil M, which is connected by the terminal E to the earth terminal of the apparatus to be protected. This release, trip operated by the coil M, is so adjusted that as soon as the leakage-current passing through the coil reaches an intensity of 15 milliamperes the circuit breaker is opened. The potential upon the protected apparatus necessary to pass this very small current can be anything between 20 and 42 volts, depending upon the actual resistance of the artificial earth, AE. Assuming this earth resistance to be 500 ohms, then the switch would operate as soon as the protected apparatus reached a potential of approximately 22 volts.

(To be continued.)

The Two-part Tariff.

A contention that the report of the Committee appointed by the Electricity Commissioners is inconclusive in many respects, and fails to take sufficient account of important aspects of the subject.*

By G. L PORTER, M.I.E.E.

ALTHOUGH it is generally appreciated that the cost of giving a supply of electricity consists of capital and running charges, it is not quite so generally realised that a corresponding two-part tariff is only rendered necessary by the divergence between the load factors of consumers. With uniform load factor

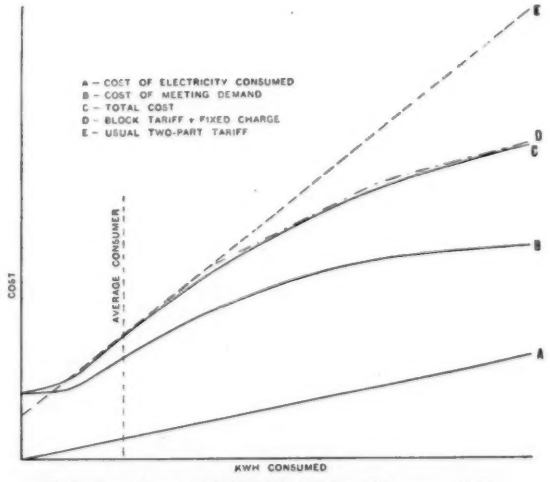


Fig. 1.—Cost of Electricity for Houses of the Same Size.

the kWh consumed will be an exact measure of the demand, and both parts of the cost can be collected by a correct flat rate per kWh. The first question is as to the cause of difference in load factor. Obviously, the size of house will have no direct effect. Any two houses having similar equipment differing only in size must have the same hours of use unless the customs of the inhabitants differ. Differences in load factor result, therefore, from differences in equipment coupled with differences in use, of which the latter cannot very well be taken into account. It therefore appears that a good deal of justification is necessary for the adoption of a two-part tariff in which the main charge is based on the size of house when that consideration alone would not make a departure from a simple flat rate necessary. On the other hand, how can a two-part tariff be correct, the demand charge of which completely ignores the factor which renders a two-part tariff necessary, *i.e.*, the electrical equipment?

Where a two-part tariff is used equity insists that each consumer should pay his correct share of both parts of the cost of supply, and one part of that tariff is concerned with the consumer's " peak responsibility." Unfortunately, this quantity is so difficult to measure that true equity is unattainable, and some quantity other than peak responsibility, but as nearly proportional to it as is practicable, must be substituted. Owing to considerations of diversity and the cost of the apparatus necessary, the consumer's actual maximum demand is not a suitable basis. It is, therefore, necessary to fall back on quantities which are only indirectly connected with the electrical installation. The Committee has recommended that the basis of floor area be taken. The great convenience of that basis is certainly attractive, but according to the Committee it is *the only basis to which there is no objection*. The Committee gives as its first advantage that " the floor area is related to the consumer's probable demand," but the writer submits that in considering the need for choosing a basis for the comparison of houses of different size insufficient weight was attached to the effect of differences in the equipment of similar houses. Certainly, for consumers whose houses might be described as equally electrified, there is probably a reasonable relationship between floor area and cost of demand, but when we compare a small all-electric house with an ordinary large house in which radiators are only used in spring and autumn, and on

* " Report on Uniformity of Electricity Charges and Tariffs," ELEC. REV., August 1st and 8th, 1930.

winter mornings before the fires are lighted, the relationship disappears. It would therefore appear that a factor is required which will take into account the degree of electrification as well as the size.

If we consider a number of houses of the same floor area, but progressively more and more electrified until we come to the all-electric house, the demands will be anything but equal, and a fixed charge on floor area altogether inequitable. It is, therefore, customary to assume that the increase in demand with more complete electrification will be accompanied by an increased consumption, and that the latter can be taken as a measure of the increase in demand. Most undertakings having two-part tariffs therefore base the fixed charge on the house with a minimum of equipment and increase the kWh charge by what is necessary to collect the capital charges on the additional demand. This method has the objection that the increase in demand is not proportional to the increase in kWh, owing partly to increased diversity among the larger number of pieces of apparatus, and partly to the fact that eventually the increase in kWh becomes mainly due to longer-hour use, such as occurs on the substitution of radiators for fires and the installation of water heaters. The curve of demand against kWh is, therefore, not a straight line, and increased use of electrical apparatus is seriously discouraged by the usual straight-line tariff. There is, however, one simple way in which a result approximating to a curve can be given, and that is the " block " or " step " method, which was summarily dismissed by the Committee in less than five lines. A step tariff coupled with a fixed charge can be made to follow any shape of curve, and in this case, of course, the fixed charge and the size of step must vary with the size of house or whatever is the basis of the comparison between different houses. With such a tariff the final price per kWh need be very little more than the actual cost to the undertaking of supplying additional units.

Fig. 1 shows roughly how the various quantities are related. Line E, to be accurate for as many consumers as possible, should be parallel to the tangent to curve C at the point corresponding to the average consumer. It is obvious that the two-part tariff recommended in the report, which consists of a line as nearly parallel to A as possible, fails to meet this condition. In the " block " tariff D has a final slope parallel to A, so that the price of all kWh beyond the two blocks is the minimum possible and the prices per kWh for the blocks are four times and twice that minimum, respectively. Such a tariff is really quite simple and the consumer is free to do what he likes, knowing all the time that what he will have to pay will increase in a known manner with his consumption. The fixed or service charge and the number of kWh in each block can be based on any of the usual considerations—size of house, number of rooms, rateable value, &c.

To re-state the matter in another way; every tariff in which every kWh is charged for at the same price, and in which the only other charge is a quantity varying only with the size of house, &c., is a straight-line tariff, the lines for different houses being parallel. Such a tariff cannot be equitable unless every increment in kWh used by a consumer is accompanied by a proportionate increment in demand. Although the latter condition does not obtain and the ordinary two-part tariff is therefore inequitable, the proportionality remains sufficiently constant over portions of the range to allow of a constant price being charged throughout that portion, each portion of the whole range being charged for at its own appropriate price per kWh.

Important general points which must be kept in mind are the average consumer's complete ignorance of the economics of electricity supply, and his natural reluctance to pay a lump sum down irrespective of the use made of the supply. This renders any attempt to collect the whole of the capital charges as a fixed charge quite impracticable. On the other hand, his experience of ordinary commercial transactions leads him to expect a reduction in rate with increase in quantity.

Coming now to a much more controversial topic—the basis of co-relaton of different houses, *i.e.*, whether floor area, number of rooms, rateable value, or some other feature should be used—it will probably clear the air if this is dealt with in a provocative manner. Even though some borough electrical engineers may refer to Public Service (with capitals) and vulgar commerce (without) the sale of electricity is, after all, merely a commercial transaction, and the ordinary laws of commerce apply. One such law in particular, which is apt to be forgotten, is that the exchange value of any commodity depends on its value to both parties and not merely on its value to the vendor. Although the cost to a seaside landlady of boarding visitors in January is greater than in August, it is customary, and indeed equitable, that the price in January should be lower than in August owing to the accommodation being so much more valuable at the latter time. Certainly one can theorise about the incidence of overhead charges, but, when all is said and done, it is only the greater value to the customer that makes possible the higher charge.

If Smith is prepared to pay twice as much as Jones, is it equitable to charge them the same price? Any vendor who adjusts his price to his market will have a larger sale, and cause less dissatisfaction, than one who sticks to a uniform price, and actually every undertaking has classes of consumer who are being " carried " by the others, although many engineers do their best to pretend that they are not. It is also the practice for large industrial power consumers to pay a charge based on the actual maximum demand made by them during the accounting period, although logically they ought to pay a fixed charge based on the allowable maximum demand stated in their contract, seeing that it is the latter figure which determined the amount of capital spent by the undertaking. The result of this practice is that industries suffering from a slump are relieved of part of the capital charges due from them at the expense of such other consumers as are prospering. In other words, the tariff is based partly on *ability to pay*.

The faults of the rateable-value basis are pointed out in the report, but the system is so extensively used that it deserves some further consideration.

The assessment of a house depends on the following :—(*a*) Size of house, (*b*) area of land, (*c*) other reasons, such as locality.

In so far as the rateable value depends on (*a*), it is equivalent to the size of the house basis recommended by the Committee. In so far as it depends on (*b*), it is a much better basis than mere size of house, as the latter takes no account of the considerable extra length of distributor per house where the number of houses per acre is less. This is an important point, seeing that more than half the cost of meeting the demand may be due to l.p. mains. With regard to (*c*), whatever justification there may be for an increase in payments for elementary education, parks, wash-houses, and the " dole," none of which are actually used by the householder in question, can surely be used as a justification for increased payment for a supply which he *does* use. The rating or valuation department has sufficient business acumen to realise that the residents in certain localities are prepared to pay more in rates, generally because money has a lower value to them than to others. This reduced value of money makes a higher price quite equitable and if, as mentioned above, " ability to pay " is taken into account in industrial tariffs, there can be no objection to it in the case of domestic consumers. It must also be remembered that any abnormality in the assessment has almost certainly been already discounted in the purchase price or the rent, as the case may be. These considerations tend to show that the rateable value basis is equal to floor area under (*a*) and superior under both (*b*) and (*c*).

With regard to another objection in the report, most undertakings which cover any considerable area find it necessary to charge a higher price in the more remote parts owing to the greater capital expenditure required to supply them, and such differences in price can easily be arranged to cover any difference in the basis of assessment.

In conclusion, might we not say that the most equitable tariff is that which renders all consumers equally satisfied (?dissatisfied) with the accounts they are called upon to pay?

Business Statistics.

A discussion on the function and purpose of a statistics department in an industrial organisation, with reference to the nature and value of the work performed by this new type of department.

By A. W. WILLSMORE, F.R.Econ.S.

PERHAPS the most striking difference between present-day business management and the type of administration practised before the war is the tendency towards the elimination of guesswork from decisions. The modern executive is not content to guide his company on rule-of-thumb practice. He demands facts, full facts of past and present conditions, and he bases his decisions on a consideration of the trends and tendencies indicated by these facts The time of a managing director is too valuable, however, for him to spend it in collecting the figures necessary to serve as the basis of his decisions. As a result there has sprung up in many industrial organisations a separate department, whose function is to collect relevant statistics and to present them in the most suitable form to guide executive policy.

The position held by the statistics department of a concern depends on the outlook of the management. Usually it acts in an advisory capacity to the managing director and chief executive. But although it is only when it operates in such a capacity that the statistics department gives the maximum return on the expenditure involved in its upkeep, it is by no means uncommon to find a statistical section acting as a subsidiary department in the sales department. The sales manager, more than any other of the managers of a company, is affected as much by outside conditions as by internal in operating his department. He is as vitally interested in the condition of his principal customers and his market in general as he is in the condition of his own company. For this reason, it is frequently found that a company tries out the innovation of a statistics department as a subsection of the sales department, and when the new organisation proves its value in the collection and analysis of outside data and sales statistics, the department is raised to a higher place in the managerial chart and is given the opportunity to extend the same methods of analysis to a consideration of the entire company and its accounting statistics.

There are two distinct attitudes towards the value of statistics in business. On the one hand, people argue that you can prove anything from figures, while, on the other hand, it is held that figures cannot lie. Neither view is strictly correct, but figures can easily be misused to convey an inaccurate picture of conditions. It is one of the functions of a statistics department to point the fallacies involved, and to present the data in such a way to enable the true conclusions to be drawn.

The object of the statistics department is to collect relevant figures and to apply scientific principles of statistical method to the tabulation and analysis of these figures. We are not concerned here with the mathematics of the methods involved. It may be pointed out, however, that with few exceptions, these are not particularly complicated, and the bulk of statistical work can be done by anyone with a good knowledge of arithmetic. Full details can be found in any standard text-book on the subject to illustrate the significance of the various types of averages employed, such as medians, modes, geometric averages, and weighted averages. It will be found that each type of average has characteristics favourable or unfavourable, depending on the circumstances and object of the study, and that in fact their value depends entirely on the discrimination with which they are used. Particulars will also be found as to how the use of these various types of averages is supplemented by a consideration of the dispersion of the figures or the extent to which the individual items vary from the standard type.

It may be advisable at this stage to draw a distinction between the work of a statistics department and that of the accounts department. The accounts department is concerned purely with the collection and verification of figures relating to past and present conditions. The purpose of the statistical section is to analyse these figures and to present them in such a way as to bring out the underlying trends and developments, and to indicate the lessons to be learned from the figures concerning probable future conditions. In effect, the accounts department gives a cross-cut picture of conditions at a particular time, whereas the statistics department studies figures over a period of time, sufficient to enable sound conclusions to be drawn as to the inter-relationship of all of the various activities of the concern and the general direction in which events are moving.

Perhaps the most useful instrument employed by a statistics section is the graph. Graphic presentation is being used more and more in all types of business because of the ease with which material so presented may be grasped, and because, by this method, differences in numerical facts from one period to another are illustrated in a way that tables fail to disclose. Graphs also facilitate the study of the trend or tendency in a group of facts, and it is by no means uncommon for a statistics section to maintain a complete pictorial record of the whole of the activity of a company.

Typical charts prepared in this connection show total net earnings, net profits, working capital, accounts receivable, inventories, expenditures, sales, orders, shipments, and labour turnover. Such charts enable the business man actually to see what he is doing and to maintain close and continuous contact with his business. Charts are also prepared to show the relationships of these various factors over a period compared with a standard or desirable limit. Every manager has certain ideas as to standards of gross profit on sales, days' sales tied up in inventories, turnover of investment, ratio of receivables to sales, relations of sales to budget estimates, and so on. These ratios are charted in such a manner that whenever any one of the factors passes the desirable limit the executive is given immediate and visual notice of the fact and can take early action to counteract the trouble.

In addition to the regular preparation of such charts indicating the trend of affairs and the balance existing in the various factors affecting a company's sales, financial and manufacturing position, there are many other directions in which a statistics organisation assists the management. All companies are affected to a degree, directly or indirectly, by fluctuations in general business conditions. The management of any company is, therefore, very much concerned in any impending changes in general trade, and the company that is able to foresee these changes is in an enviable position compared with a company without such knowledge.

With this object in view, statistics organisations, attached to private companies and to business research bureaux, have done much valuable work in establishing methods suitable for providing advance indications of major developments in business conditions. And although they are still far from arriving at a formula for forecasting the exact date and extent of the impend-

ing change, sufficient has already been discovered to enable forecasts to be made that serve as real practical assistance to executives planning to meet future conditions. The studies made by private companies in this connection are, of course, supplemented by an investigation into the exact relationship between general business and the business of the company, so that the executive can see to what extent it feels the effect of changes in general business and what lag or lead there is between these changes and changes in its own company. Arising out of this investigation, the company also obtains information regarding the actual trend of sales in the past and the seasonal nature of the business that is very valuable in enabling forecasts of future sales to be made as the basis of plant expansion, and in enabling plans to be laid for stabilising output through the year in spite of seasonal fluctuations in demand.

The statistics department also assists the management in connection with the question of introducing new lines. In many concerns, if any estimate is made at all, the estimate of probable business upon which the decision to introduce a new line is based is little better than a guess, and it frequently happens that the actual demand is insufficient to cover the initial development expense and marketing cost. Where a statistics department exists, however, a careful study is made of the market, taking into account all the factors likely to have a bearing on the situation, and a really reliable estimate is thus obtained.

There are many other fields in which a statistics department can be of real assistance, one of the most important being the purchasing department. Here, the statistics section furnishes careful studies for each of the commodities in which the company is interested, showing the trend of prices and illustrating the price-determining factors such as consumption, production, and available stocks. The collection and analysis of this data is a task for which the statistician is eminently suited by virtue of his training, and it is found in practice that he can provide services of inestimable value to the purchasing manager in this direction.

In short, it is doubtful whether there is any phase of business activity where the statistics department cannot provide valuable help in an advisory capacity, and it is believed that within a few years the majority of progressive concerns will be enjoying these facilities.

More Tales Engineers Tell.

By CAM.

IT has recently been alleged that central station engineers do not tell tales of their experiences. Granted that they admit themselves less verbose than their mains department contemporaries, they can, when so disposed, tell of experiences which, though hardly running cold shivers up and down their listeners' backs, at least absorb their interest during the telling

For experiences, humorous and otherwise, give me the power station, despite all its vicissitudes. After my short sojourn on the mains, which included a particularly severe winter, I returned to station work like a bird to its nest, with impressions only of cold feet and frost-bitten fingers. Since then, however, I have been able to appreciate the humour of ringing up the mains' men in the early hours of a winter morning to report a fault which necessitates their turning out at once. In fact, that is one of the night shift charge engineer's most pleasant duties.

When Winter Came!

Whilst on the subject of cold jobs, here is a rather good one. At a certain station some years ago the a.c. load after midnight was zero, and the turbines were therefore shut down and the d.c. load was transferred to a storage battery, which usually sufficed until the turbine was again started up. As stand-by a reciprocating engine was kept warmed up in case it was required. One Christmas Eve the usual routine was carried out, the steam by-pass valve to the engine just cracked and everyone settled down for the night. The engine driver made himself comfortable on the bed of the engine and presumably fell asleep—it was Christmas Eve, or rather early Christmas morning; several hours later the shift engineer dug him out to start up the engine. The unfortunate man was sitting in icy cold water about an inch deep. He had inadvertently left the drain from the steam separator turned to atmosphere instead of to the steam trap and, although the water which was trickling from the drain was nearly boiling, it had accumulated on the engine bed and cooled down to very near freezing point. The driver's remarks on awakening certainly did not constitute a carol, and he found it necessary to sit on a sack on the top of the economiser for some considerable time before he could move about with any degree of comfort.

At the same station one of the stokers was reputed to be something of a crack runner, and one evening he was visited by another local runner, whom he had not previously met and who wished to challenge him to a match. The interview took place in front of the boiler to which the stoker was attending, and, whilst the terms of the match were being argued over, a gauge glass blew out. The velocity which the challenger attained in reaching the boiler house door settled the argument, for the stoker turned down the challenge.

"Fire!"

The story of the fireman who thought it impossible to receive a shock along the water from his hosepipe, because the water moved so quickly, brings the following story to mind. In one town a large mill caught fire and three or four firemen received a very severe shock due to the water from their hose coming into contact with live gear in a transformer sub-station at the mill. The fire station was adjacent to the electricity works, and it was arranged that in the case of a fire alarm being given one of the junior engineers should go immediately to the fire station in order to ascertain the source of the alarm, so that in the event of its being any works supplied at high voltage, the feeder could be switched out until the building had been isolated so as to prevent any recurrence of the mishap. If the fire authorities were not sure of the origin of the alarm the junior had instructions to join the first engine which turned out, proceed to the scene of the fire, and report to the works by telephone as soon as possible. This arrangement worked quite well for some time, the juniors slipped into the fire station, obtained the required information, and were back in the works again in a few minutes. However, the fire hooter blew one morning about nine o'clock and the junior on shift, who had not previously been on duty when an alarm was given, dashed into the fire station and in the excitement forgot to ask any questions, but mounted the first engine and hung on like grim death as the machine turned out and dashed through the town. Imagine his feelings when the engine carried on straight through the town and out into the country. Finally he turned to a fireman next to him and asked somewhat sheepishly where the fire was. "Oh, its at B—," was the reply. The engine was answering a call from a neighbouring rural district about eight miles away. When the junior returned to the works some five hours later and reported a stack fire at B— he brought the house down.

Extinguisher Extinguished!

At another works a scene which would not have been out of place in a Chaplin film was staged one day, due to a small flare-up behind the switchboard. The affair occurred in the middle of the day when several men were available to give a hand. One of these men, seeing the smoke, seized a five-gallon fire extinguisher of the type which requires tipping up for it to discharge its contents. The switchboard steps being rather narrow and the man being unaware of the operation of the extinguisher, swung it on to his shoulder for easier carrying. The contents immediately commenced to discharge, and as the stream was directed into the man's ear he promptly turned it round and raked the length of the switchboard gallery; switchboard attendants fled, and one luckless fellow coming through a door at the crucial moment received the stream in the centre of his waistcoat and promptly returned the way he had come. The embryo fireman, clutching the infernal machine in his arms, staggered back down the steps into the engine room, scattering everyone within his line of fire, and finally contrived to place the extinguisher under a packing case on which he sat until the contents were spent; meanwhile the small conflagration had burnt itself out. This occurred several years ago, but the man still rejoices in the name of Fireman F——, and he is apt to get hot round the collar if anyone mentions fire-fighting appliances to him.

"Please to Remember."

On November 5th a few years ago a very severe fault occurred on the network of a fairly large town; manhole lids and a large portion of the roadway were blown up and several windows in the vicinity shattered. The chief engineer of the undertaking visited the works, and as several feeders affecting about half of the town were involved he was somewhat perturbed. Whilst he was discussing the affair with the charge engineer on shift, a man dashed up with the news that the battery room was on fire. The charge engineer rushed off to the battery room and with the help of a few men and several buckets of water quenched a small fire which had broken out in a large stack of wood separators. The chief and the charge engineer returned to the engine room, where the latter, a rather phlegmatic individual, remarked that the occurrences were quite seasonable. "What the —— do you mean?" asked the chief. "Well, Sir, it's Gunpowder Plot night," replied the charge engineer. That his term of service did not cease forthwith was due, probably, to the fact that the chief was too speechless to pronounce sentence.

"In Cellar Cool!"

In the late hours of the evening a certain shift engineer was whiling away the time chatting with his leading stoker. No doubt they were telling of their doings in days gone by, when one of the other stokers came along to say that he had heard some mysterious noises in the boiler house basement or ash cellar. The two one-time heroes went to the steps to listen, finally deciding that there was someone there. After a little discussion, and no one being keen on investigating, it was decided to send for the police, who duly arrived—two of them. All then adjourned to the ash cellar where, sure enough, two men were found—a wireman and his mate who were repairing the lighting system which had failed during the day. The super had forgotten to leave word that they would be working over!

"More Light!"

Another shift engineer, who was the proud possessor of a powerful torchlight which he used on every possible occasion, one day withdrew a wrong set of isolators during a rather complicated changing over of bus-bars. The resulting flare up earthed the bars, shut down the station, and reduced the shift engineer to a state of temporary blindness. Shuffling out of the cell chamber he was met by one of his men, a broad Yorkshireman, who asked "What's up?" "I don't know; I can't see," replied the unfortunate shift engineer. "Tha' can't see! Well, weirs thi flashlamp?" was the man's staggering rejoiner.

There are many more tales which could be told, but several must be kept for another time, and I had perhaps better conclude with the one of the switchboard attendant who took the opportunity of being on night shift to have a bath in the bathroom provided by a philanthropic management. He, however, chose the wrong night, for the plant shut down while he was indulging and he finished his bath on the switchboard with a towel round his middle.

Reviews.

Rural Electrification. By ALFRED EKSTROM, D.Sc., M.I.E.E., and VIDAR EKSTROM, C.E. Pp. 103; figs. 19. Published by the authors. Obtainable from the ELECTRICAL REVIEW, LTD. Price 3s. 6d. net.

This little book is rather better described by its sub-title—"Safety Devices in Connection with Low-Tension Distribution"—with which important matter the authors are chiefly concerned.

The great question of electrical safety has yet to be adequately tackled by the electrical industry in this country, and this book will rather open the eyes of many engineers as to the numerous directions in which the generally accepted means of preventing shock fall short of the ideal. The man who is thinking things out for himself will receive valuable assistance from the unbiased conclusions drawn in this booklet, following careful examination of all protective measures in use, not only in this country but also on the Continent.

Chapters I and II deal with electrical accidents, and these are presented in tabular form compiled after reference to reliable sources, while Chapter III deals with faults occurring in overhead distribution systems. Chapter IV closely examines earthing as a leakage protective device, and in this chapter also the exceptionally interesting system of "artificial earthing," which is in common use on the Continent, is touched upon. This system is at last receiving a small measure of the attention that it deserves from the British engineer, as although protective switching has been adopted extensively in Germany and is even compulsory with some supply authorities there, yet the principle and its application are almost unknown in this country.

The undoubted advantages which artificial earthing possesses over our cruder systems of protection are convincingly demonstrated. Chapter V deals with connection to the neutral conductor as a leakage protective device, and the promising possibilities of insulation towards the same end are discussed in Chapter VI. Numerous illustrations and diagrams are provided by the authors, whilst the table on page 78, having reference to the conditions in the neutral conductor, should be especially useful.

Altogether, this booklet should be in the hands of every engineer concerned with rural electrification schemes, whether on the supply or installation side, to whom it will prove not only of interest but also of value. The commonsense way in which electrical safety problems are discussed in this publication is decidedly refreshing after the complacent attitude generally adopted by writers and engineers towards these questions, even by those—to quote the Chief Electrical Inspector of Factories—"who by virtue of their responsible position with regard to the safety of others, ought to be fully cognisant of the facts."

T. C. G.

Theorie der Elektrizität, Band 1. By ABRAHAM-BECKER. Pp. iv+242; figs. 59. Leipzig and Berlin: R. G. Teubner. Price 15 m.

The first edition of this book appeared in 1894 as an introduction to the "Maxwellian Theory." The second edition appeared ten years later as the first volume of "Electrical Theory." For the intervening period between that time and to-day, the succeeding editions, of which the one under review is the eighth, have been recognised as standard advanced text books in Germany. It is, therefore evident that there is here something which is of outstanding value.

The book contains four main sections, which deal with:—(*a*) Vectors and vector fields; (*b*) the electrostatic field; (*c*) the electromagnetic field; and (*d*) the application of the Maxwell theory to energy and power.

Sub-sections I and II, which form the first main section, deal with the general and purely mathematical conception of vectors. They take the reader through all stages of the subject, from the elementary and almost self-evident aspects to the most advanced and abstruse, concluding with tensors and polar and axial vectors.

Section (*b*) has four sub-sections:—(i) The electrostatic field in vacuo; (ii) dielectrics; (iii) energy and mechanical forces in the electrostatic field; and (iv) the stationary electric current.

The sub-sections of Section (*c*) are:—(i) The magnetic vectors; (ii) electrodynamics of stationary media; (iii) the electrodynamics of quasi-stationary currents; and (iv) electromagnetic waves.

Section (*d*) has two-sub-sections:—(i) Thermodynamics of field energy; and (ii) forces acting in fields varying with time.

There is a complete table of contents, a collection of important formulæ and relationships, and an index.

The book is one for physicists rather than engineers, and only those who have attained the advanced honours stage of pure mathematics will be able to derive benefit from it without intensive application. It is worked out so fully, logically and completely that criticism on the part of anyone who is not a master of mathematics would be impertinence. The strictly utilitarian mind might, however, be tempted to ask why the practical examples given are such as to be capable of solution by comparatively elementary methods without using the formidable weapons of analysis which form the major portion of the book.

The printing and general production of the volume are excellent.

Business Charts. By T. G. ROSE, M.I.Mech.E. Pp. x+94; figs. 31. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

Graphic presentation forms a peculiarly concise and informative manner in which to record commercial activity, and the present-day business man is coming to realise more and more clearly that such a record of all phases of business activity is of great practical value to him in controlling and guiding the machinery of his organisation. Unfortunately, however, the majority of text-books on business graphics are written in such a style that the beginner gets a false idea of the complexity of the subject, and generally cannot see the wood for the trees. The present book is to be welcomed in that it forms a clear and concise introduction to the problem, which, while not being too short to give an adequate survey, compresses the main principles of graphic presentation in a remarkably brief compass.

The book is the outcome of a series of articles on business statistics recently published in *The Times* Trade and Engineering Supplement, but the subject has been developed rather more fully than in the original series.

In effect, the book represents an explanation of the most common types of business charts found in practice, such as the various types of illustration charts, bar charts, and line charts. A special section is given to the Z chart, by the use of which it is possible to show on one chart the progress of current and accumulative results, and also the general trend of the figures. A chapter is also devoted to rate of change charts, in which the principles underlying this type of chart are established, together with indications as to the type of data for which it should be employed.

Perhaps the most valuable pages of the book are those dealing with recommendations for the proper making out of bar and line charts. These recommendations represent the result of the deliberations of a Joint Committee on Standards of Graphic Presentation formed under the auspices of the American Society of Mechanical Engineers. The author develops these recommendations with valuable comments on their importance and significance, and he adds further suggestions based on his own experience, together with a final chapter containing general advice on the use of simple graphs for business purposes.

The author does not attempt to give a complete review of the subject. The advanced graphic forms—which, although complicated to the initiate, are nevertheless of inestimable value in business statistics—are omitted, and the author recommends the reader to pursue his study of the subject by the purchase of one or more of the advanced text-books on the subject. For this purpose, he includes a bibliography of some of the more important works on graphic methods.

Bearing in mind the aim of the book, it is perhaps unfair to criticise the author on the ground of omitted material. We feel, however, that the value of the book would be considerably enhanced by the inclusion of a chapter on Gantt charts. Production control is one of the most fertile fields for the application of graphic methods, and the Gantt chart—which is a combination of the bar chart and the symbolic chart—is the chart most frequently encountered in that field. To make way for the inclusion of such a section, we would suggest the curtailment of the chapter on the little used pie charts, concerning which the author's comments are mainly, and rightly, of a destructive nature.

In all, however, the book is a very valuable introduction to the subject of business statistics, and the author is to be congratulated upon having compressed into so small a volume sufficient of the principles of graphic presentation of business statistics to enable the beginner to obtain a clear grasp of the subject, and to apply graphic methods to his own problems.

Technical Data on Fuel. Second Edition. Edited by H. M. SPIERS, M.A., B.Sc., F.I.C. Pp. xiv+242; illustrated. London: The British National Committee of the World Power Conference. Price 12s. 6d. net.

This useful handbook hardly needs any introduction to fuel technologists, for the first edition was produced and published by the British National Committee of the World Power Conference at the time of the London Fuel Conference held in 1928. The first edition was so well received that the Committee decided to collect further data and produce a revised and enlarged edition. The contents have been increased by approximately one-third by additions to the various sections and the introduction of new matter. Not only does this publication bring together data on widely diversified branches of fuel technology, which could not otherwise be studied without reference to a large number of handbooks, but it also includes much information supplied by various organisations which has not hitherto been published for the benefit of the general public. The work has been brought thoroughly up-to-date where necessary by references to, and extracts from, articles which have been written since the first edition was compiled.

In addition to the numerous tables and diagrams the book contains a large proportion of text in explanation of the derivation and proper use of various equations and tables. The way in which the various data are presented is in fact highly commendable, and the method of using conversion tables, for example, is clearly indicated. Much information of a general nature is given in the text, and there are several signed contributions by experts on various subjects.

Regarding the actual subject matter, only approximately the last third of the book deals directly with the properties and utilisation of solid, liquid, and gaseous fuels. The first portion deals with methods of measurement of specific gravity, gas velocities, furnace temperatures, steam flow, viscosity, &c., to quote only a few headings. The flow of fluids in pipes is considered at some length, and the relationship between viscosity and friction losses is explained. This information is not usually given in text-books on hydraulics, but we must confess that if we required quickly a reasonably accurate estimate of the loss of head in a water pipe line we should be tempted to use the formulæ and empirical constants given in most handbooks, rather than first to determine the appropriate constants as explained in this handbook. When such a calculation is of a critical nature, however, we have no doubt that the more scientific method would be far preferable.

In the preface criticism is to some extent forestalled by the statements that no attempt at completeness has been made, and that the selection of the subject-matter has been somewhat arbitrary. In a note to the second edition, however, the editor invites suggestions as to data that might usefully be included. We therefore venture the opinion that the book would be even more useful to the combustion engineer if it contained some more information on the practical utilisation of fuels. For example, there is a note on the calculation of chimney draught, but no information on the use of forced- and induced-draught fans. The formula for the power required by a fan when handling a given weight or volume of gas at given temperatures and pressures would, we think, not be out of place. How many engineers can calculate the speed required by a fan for given conditions, or even appreciate the fact that the draught requirements increase roughly in proportion to the square of the boiler load, and the power absorbed by the fans, if of the variable-speed type, in proportion to the cube of the load? Several charts are included giving the stack losses with different fuels and varying percentages of excess air, and these might be supplemented by instructions on the method of calculation of such losses and the compiling of heat balances. We do not think these suggested additions would fall outside the scope of the book, and they could be included without necessarily increasing the bulk, since there is a large number of blank pages on which the owner can insert his own notes.

Perhaps we can best sum up by saying that the book is certainly cheap at its price.

R.H.A.

Electrical Power Transmission and Interconnection. By C. DANNATT and J. W. DALGLEISH. Pp. xi+424; 112 illustrations. London: Sir Isaac Pitman & Sons, Ltd. Price 30s. net.

During the last 10 or 12 years the theory and practice of the transmission of electric power has made such enormous progress that it has been almost impossible for any but the transmission specialist to keep pace with all that has been published on the subject. For this reason alone, therefore, the present volume, representing as it does an introduction to the varied aspects of modern power transmission, may be regarded as particularly opportune. Broadly speaking, the book deals with the electrical constants of, and phenomena associated with, overhead and underground conductors, the theory and calculation of electrical networks and interconnected systems, system performances, including studies of power limit and stability under steady and transient operating conditions, and the various kinds of transient electrical phenomena arising from internal and extraneous sources. In each chapter the salient features of the problems are outlined, the basic details being woven in to establish the soundness of the technological fabric.

References to associated papers published elsewhere are given by means of which fuller studies of the subjects may be made.

The work is an exceedingly good one, and it maintains the high standard which has now been set by other writers on technical engineering subjects. Its value to the electrical engineer is beyond all question, and we welcome its appearance among contemporary literature.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The E.D.A.-E.L.M.A. Campaign.

The latest report on the progress of the E.D.A.-E.L.M.A. Shop and Display Lighting Campaign states that 7,000 shops have already been surveyed and 3,350 inquiries of all classes have been received by E.D.A. as a result of the circulation of direct-mail literature and Campaign advertisements. It appears that a considerably greater number of inquiries have been made directly to electrical shops and showrooms. The report contains particulars of a further 32 lecture demonstrations which have been organised in towns in Great Britain and Northern Ireland. The mobile exhibition of electric signs has been well received, and in one town 40 inquiries from shopkeepers regarding signs resulted. Additional shop-lighting competitions have been organised, or are contemplated, in Taunton, Wakefield, Dewsbury, Leeds, Leigh, Dundee, Bangor, Lurgan, Newry, Worcester, Nottingham, and Chepstow, raising the total number to 43. The results of competitions at Torquay, Newton Abbot, Plymouth and Dursley are given in the report.

The B.E.A.M.A. Annual Dinner.

The annual dinner of the British Electrical and Allied Manufacturers' Association will take place on Wednesday, November 19th, at the Connaught Rooms, Great Queen Street, W.C.2. Lord Derby will be in the chair, and the speakers will include the Minister of Transport (Mr. Herbert Morrison), the Rt. Hon. Winston Churchill, P.C., M.P., Sir Hugo Hirst, Bt., and the Rt. Hon. Sir E. Hilton Young, P.C., M.P.

United States Electrical Exports.

The total value of electrical equipment shipped from the United States during August last was $9,780,692 as compared with $11,722,620 in the corresponding month of 1929. Among the classes which contributed to this decrease were the following:—Transforming and converting apparatus, $362,606 against $404,611; motors, starters and controllers, $1,040,657 against $1,240,200; refrigerators, $722,724 against $1,437,304; radio apparatus, $1,874,371 against $2,302,953; telephone apparatus, $404,842 against $493,248; and electrical porcelain, $80,813 against $185,477. The total value of electrical exports for the first eight months of the year was $90,899,154 as compared with $95,736,401 during January-August, 1929. In August Canada was, as usual, the United States' largest customer, her share being valued at $2,638,393. The United Kingdom came second with $676,440, and other leading markets were Argentina ($644,758), Mexico ($460,119), and Soviet Russia ($436,163).

The United States' imports of electrical goods had a value of only $332,087, an increase of $102,899 as compared with August last year. The principal items were lamps from Japan and vacuum cleaners from Sweden.

Contractors' Fire Insurance.

At last year's annual conference of the Electrical Contractors' Association Mr. H. Marryat called attention to the fact that an electrical contractor had been held liable for a fire which occurred on a client's premises while installation work was being carried out. The damage was calculated at £28,000, but the Association's standard insurance policy only covered risks up to £10,000. It is now announced that the E.C.A. is negotiating a floating policy on behalf of all its members which will cover the liability of any individual member for the difference between £10,000 and £25,000 in the event of his being held liable for damage by fire on another party's property.

Marconi Marine Communication Agreement.

An agreement has been arrived at between the Marconi International Marine Communication Co., Ltd., and the Chamber of Shipping of the United Kingdom and the Liverpool Steamship Owners' Association with regard to the terms under which the Marconi Marine Company is prepared to carry out marine wireless on British ships in the future. As a part of this arrangement the Marine Company has appointed to its board Mr. A. Shaw, a nominee of the shipping industry. Mr. Shaw is a deputy-chairman of the P. & O. Steam Navigation Company and a director of the Bank of England.

British Factories in Canada.

An Industrial Branch, whose primary object is to interest British industrialists in the establishment of factories in Canada, has just been established in London by the Canadian National Railways. Mr. T. A. Hooker, who will have charge of the branch, has returned to London after a six months' tour of the Dominion where he investigated practically every field of possible industrial expansion and enlisted the co-operation of the Boards of Trade and Chambers of Commerce in the furtherance of his work. Through the London office it is intended to furnish information on the industrial and commercial possibilities of any part of the Dominion and to facilitate investigation of specific industrial projects.

The Contractors' Dinner and Convention, 1931.

The annual dinner of the Electrical Contractors' Association is to be held in London on January 28th.

It is also anticipated that the E.C.A. Annual Conference will be held in Eastbourne in June next.

Siemens Lamp Publicity.

In connection with the sales aids and publicity scheme of Siemens Electric Lamps and Supplies, Ltd., we have received from the company the accompanying illustration of a recent showroom window display by the Newcastle-upon-Tyne Electric

A Siemens Lamp Display at Newcastle.

Supply Co., Ltd., from which it will be seen that Siemens pearl and opal lamps are specially featured. The employment of the "Popular Pair" centrepiece and cut-out figures, together with the actual lamps, resulted in an artistic display.

A Large Electric Sign in Capetown.

The British General Electric Co., Ltd., of Capetown, was responsible for the supply of much of the material used in the construction of a large electric sign for the Atlantic Refining Co. in Capetown. This is of the double-sided type, and the letters are 12 ft. high, the overall length of the sign being approximately 70 ft. It has a border of green, and the word "Atlantic" is formed by Osram daylight blue lamps. On top of this is the word "Petrol" carried out in Osram amber colour sprayed lamps. The sign is operated by a 3-way flasher, the cycle being:—Border, "Atlantic" and "Petrol." Over 2,000 "Osram" lamps are employed in this sign. A similar type of sign is being erected at East London.

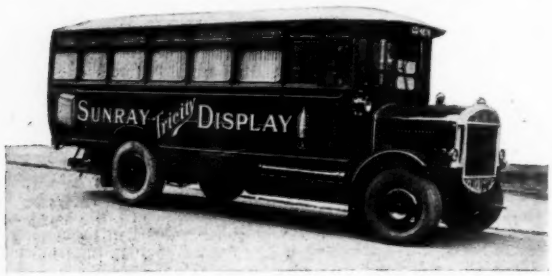
The British Engineers' Association.

At yesterday's informal monthly luncheon, Brig.-Gen. Sir Henry Page Croft, Bt., M.P., was to deliver an address on "Home and Empire Tariff Policy."

D

A New Display Caravan.

On Monday evening last a new Tilling-Stevens wagon acquired by Modern Electric Homes, Ltd., was on view in Lincoln's Inn Fields, London, W.C., prior to a tour of the principal watering places, including Bournemouth and Torquay as its first stops. The caravan is divided into two rooms. The front compartment, measuring 15 ft. 8 in. by 6 ft. 8 in., is equipped as an attractive sun-parlour with a range of "Sunray Tricity" radiators, and the principal duty of the caravan will be to demonstrate their merits to hotel proprietors. The company is prepared to supply on hire-purchase "Sunray" radiators with portable slot-meters for hotel bedrooms, and to accept in payment the monetary contents of the meters until the equipment has been paid for. The rear compartment



A "Tricity" Travelling Showroom.

(6 ft. 8 in. by 4 ft. 10 in.) is fitted up as a kitchenette, with a "Tricity" cooker and hot cupboard. Electricity is supplied by a dynamo, with a normal output of 10 kW at 100 V, driven by the engine.

The South African Domestic Appliance Market.

A South African correspondent of the *Chamber of Commerce Journal* states that "a technical man, sent out by a British engineering firm, has gone back extremely impressed with the possibilities of the domestic electric field. He considers that outside of three or four towns this field has hardly been scratched. Gas competition, he noted, was non-existent for practical purposes, domestic coal is seldom cheap, and all other competitive forms of heating and illumination are expensive, and the general level of electricity tariffs here compares more than favourably with the position, for example, in Great Britain."

Wages in the Electrical Contracting Industry.

The following agreement was arrived at by the National Joint Industrial Council for the Electrical Contracting Industry at a meeting held on November 6th:—

In accordance with the national wages agreement between the Electrical Trades Union and the National Federated Electrical Association, dated August 7th, 1920, the respective parties hereby accept the joint recommendations of their national executives, and agree to substitute the following for the wages variation agreement dated September 22nd, 1921:—

(1) There shall be variations of the April, 1921, rates of all grades, which variations shall be ascertained by a small committee of both sides in October, 1930, and March, 1931, and thereafter at twelve-monthly intervals, and shall come into operation on the second pay-day of the month following the meeting of the committee for the period covered by that pay-day. Notwithstanding the foregoing, it is understood that the result of the first ascertainment (October, 1930) shall come into operation on the first pay-day in January, 1931, for the period covered by that pay-day.

(2) Such variation to be 1 per cent. (one per cent.) for each complete 3 (three) points variation in the Board of Trade cost of living figure ("all items") from 150 per cent. above July, 1914, taking the average of the figures published on or about the 18th of the month in which the committee sits and of the thirty-five preceding months.

(3) The committee at its twelve-monthly meetings shall, in arriving at the rates payable for the ensuing period of twelve months, calculate the net result of the variation (if any variation be called for by the terms of the agreement) and shall declare the resultant net hourly rate for each grade of the national wages agreement of August, 1920, and in making such calculations any final fraction of a penny less than one-eighth shall be ignored and any final fraction of a penny of one-eighth or over shall be counted as a farthing.

As a result, the rates of wages will be increased on the first pay-day in January, 1931, as follows:—Grade A, 1s. 10½d. per hour; Grade B, 1s. 7½d.; Grade C, 1s. 6d.; and Grade D, 1s. 4½d.

Local Exhibition.

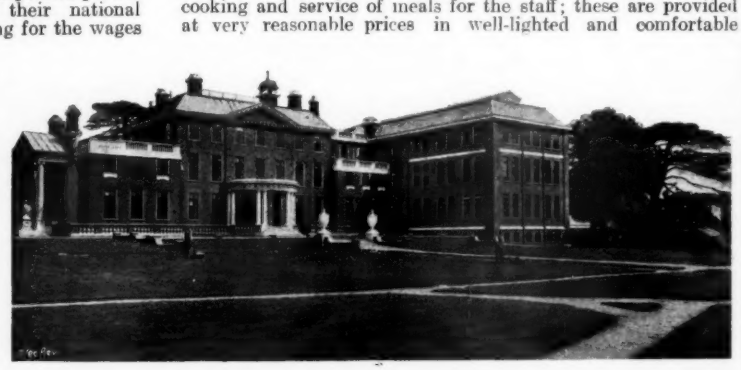
An electrical exhibition organised by the Alton and District Electricity Supply Co., Ltd., was held recently at the Assembly Rooms, Alton. Prominent electrical manufacturers co-operated to make the exhibits thoroughly representative of modern progress in the use of electricity in the home. The British Electrical Development Association was represented by a beautifully modelled statuette representing the Lady of Light, set back in a draped alcove and brilliantly illuminated by 500-watt spotlights. Immediately adjacent to this exhibit the General Electric Co., Ltd., staged an imposing display of "Magnet" products, including electric cookers, fires, and other domestic appliances. At night the Assembly Rooms and adjoining gardens were floodlighted by 1,000-watt "Osram" lamps, specially installed for the occasion. At the inauguration ceremony, Mr. K. A. Scott-Moncrieff, chairman of the Supply Company, announced that Alton had been selected by the Central Electricity Board as an important distributing centre.

The New "Northmet" House.

The administration of an undertaking with 70,000 consumers is a formidable task and one that necessitates a great deal of office accommodation. Economy and efficiency are obtained by centralising many branches of activity as the North Metropolitan Electric Power Supply Co. has proved by concentrating its administrative work in a spacious building at New Southgate, which it recently acquired on very reasonable terms and to which brief reference was made in our issue of July 11th. This building, although dating from 1715, proved ideal as a nucleus for the new headquarters of the company. The apartments, all of ample dimensions, have been allocated to various departments of the organisation and a great new wing, built in similar style to the mansion, has been added. It is intended eventually to balance this by a corresponding wing on the other side of the original building. The main entrance hall is very impressive; a broad oak staircase leads to a gallery on two sides of the apartment and the walls and ceiling are covered by a huge allegorical painting executed in 1728 and in excellent condition. The secretarial organisation, which is in charge of Mr. Evelyn Boys, occupies the first floor of the old building and the ground floor and first floor of the new wing.

Wherever possible mechanical aids are employed and the result is one of the most up-to-date systems which we have seen. All the consumers' accounts are dealt with here and the necessary forms are not only filled in and the amounts calculated mechanically, but they are actually printed on the premises. The reading of the meters and making up of accounts four times a year would be a colossal task and accordingly the work is done continuously so that each consumer gets his bill once in three months although not necessarily at the regular quarter-day.

Capt. J. M. Donaldson, the chief engineer, and his staff are also accommodated in the new premises. There are separate offices for the chief and his deputy and personal assistant, the power station engineer, the relay engineer, the mains engineer, the technical assistant, the engineering assistants, the architectural assistant and the consumers' engineer. There are also separate drawing offices, well-lighted and roomy, for the engineering, electrical and architectural draughtsmen. In the basement adequate arrangements have been provided for the cooking and service of meals for the staff; these are provided at very reasonable prices in well-lighted and comfortable



Headquarters of the North Metropolitan Company at New Southgate.

rooms. The kitchen, of course, is all-electric. The heating of the building is by means of hot water supplied from two large storage tanks in the basement. The heating arrangements for these provide a load of 440 kW which is put on the mains during the night hours, a short-period boost being given at the low-load period about the middle of the day. Thermostatic control is fitted, and where necessary auxiliary heating arrangements, fires or panels, have been put in. The company's frequency is controlled and consequently mains-type clocks can be, and have been, installed throughout the building. The grounds surrounding the house have been laid out with lawns and flower beds, and adjoining the grounds some hard tennis courts have been provided for the use of the staff. The accompanying picture gives an idea of the substantial character and size of "Northmet" House.

Electric Lighting Design.

At a meeting of the Design and Industries Association to be held at the Institution of Electrical Engineers on November 25th, the chair will be occupied by Mr. H. T. Young, and the subject of "Modern Designs in Electric Lighting" will be discussed. The principal speakers will be Mr. R. D. Best and Mr. R. McGrath, A.R.I.B.A.

Bankruptcy Proceedings.

V. R. SHEWAN & A. L. GRACE (Avon Radio Manufacturing Co.), wireless manufacturers, Long Ashton, Somerset.—Receiving order made October 30th on debtors' own petition.

F. W. HODGES, electrical engineer, 9a, Station Hill, Kidderminster.—Receiving order made October 30th on debtor's own petition. First meeting November 17th, at the Lion Hotel, Kidderminster; public examination November 25th, at the Town Hall, Kidderminster.

W. V. OWEN, electrical engineer, 1, Church Street, Tremadoc. —First meeting held November 12th, at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester. Public examination December 12th at the Court House, Portmadoc.

D. C. BREGA (Brega's Radio Service), wireless and gramophone dealer, 305, King's Road, Chelsea, S.W.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1, appointed October 30th.

THE MARQUESS OF WINCHESTER, 1, Portland Place, W., company director.—Receiving order made November 6th on a creditor's petition. First meeting November 19th, public examination December 16th, both at Carey Street, W.C.2.

[The Marquess of Winchester is chairman of the Victoria Falls and Transvaal Power Co., Ltd., and a director of the City of London Electric Lighting Co., Ltd., and many other companies.]

Company Liquidations.

CLASSIC RADIO & GRAMOPHONE CO., LTD., 25, Eccleston Street, S.W.—The statutory meeting of creditors was held on October 31st, at the offices of Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, Aldersgate E.C. Prior to the meeting the shareholders had passed a resolution nominating Mr. E. H. Hawkins as liquidator. The latter submitted a statement of affairs which disclosed liabilities of £4,476, and the value of the assets was put at £2,246. The nominal capital was £2,000, but only 302 shares were issued, and those were subscribed for in cash by Mr. Fielding, who had been the managing director, and his wife. The position of the company was attributed to severe competition and difficulties with regard to the manufacture of certain parts of portable sets. Mr. Fielding had financed the company from time to time, and he was now a creditor for £1,482 for actual cash advanced, in addition to which he was the guarantor for part of the bank overdraft and was under liability in other directions. The appointment of Mr. Hawkins as liquidator was confirmed, and an advisory committee was appointed consisting of four of the principal trade creditors.

READ RADIO, LTD., 32, Newman Street, W.—A meeting of creditors was held on October 31st, when the managing director stated that the total liabilities amounted to £1,173, including a bank overdraft of £800, which was guaranteed by the directors. The trade creditors' claims totalled £198 and there was rent due. The assets amounted to £99, the principal item being stock which had cost £312, but which was expected to produce £66 under a forced realisation. Prior to the meeting the shareholders had nominated Mrs. Delooze to be liquidator of the company, but the creditors decided that Mr. Crane, of Messrs. Crane, Houghton & Crane, should be appointed liquidator in place of Mrs. Delooze.

NORTHALLERTON ELECTRIC LIGHT AND POWER CO., LTD.—An extraordinary general meeting of shareholders has been called for November 28th to consider a resolution for the voluntary winding-up of the company and the sale of the concern to the Cleveland and South Durham Company. The purchase price is stated to be about £16,000, and the proposed change is due to the development of the Government scheme. Until the erection of the grid station at Northallerton, the works will continue to operate as usual.

EYNSHAM LIGHT, HEAT AND POWER CO., LTD.—A meeting of members will be held on December 9th at 2, The Abbey Garden, S.W.1, to receive an account of the winding-up of the company by the liquidator, Mr. W. H. Topley.

PREMIER HIRE-PURCHASE CORPORATION, LTD.—Proofs of claims by November 24th to the liquidator, Mr. D. Roth, 6, Vigo Street, W.1.

EARLSDON RADIO SUPPLIES, LTD.—Liquidator, Mr. L. A. West, 22, Regent Street, Park Row, Nottingham, Official Receiver, released October 31st.

APEX MAGNETO CO., LTD.—Particulars of claims by December 24th to the liquidator, Mr. A. L. Price, 8, Exchange Street, Manchester.

Dissolution of Partnership.

DOMESTIC ELECTRICAL APPLIANCES CO., electrical and radio dealers, 6, Fitzalan Place, Cardiff.—Mr. E. Hole and Mr. I. Phillips have dissolved partnership. Mr. Hole will attend to debts and carry on the business.

Meeting of Creditors.

INTERNATIONAL ELECTRIC CO., LTD., Tottenham, N.17.—A meeting of creditors has been called for November 18th at the Holborn Restaurant, W.C.1.

Unemployment.

An increase of 38,213 in the number of registered unemployed was recorded during the week ended October 27th. At that date the total was 2,237,501, as compared with 2,199,288 on October 20th, and 1,234,388 on October 28th, 1929.

New Catalogues and Lists.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1.—Folder, giving particulars and prices of new grip type jointing sleeves.

MIDLAND ELECTRIC MANUFACTURING CO., LTD., M.E.M. Works, Barford Street, Birmingham.—An illustrated and priced list of "Memota" motor starting switches with particulars of an extension of the voltage range.

BAXTER & CAUNTER, LTD., 221, Tottenham Court Road, London, W.1.—The November issue (No. 57) of the company's electrical accessories list.

ALAN WRIGHT, 117, Victoria Street, London, S.W.1.—A leaflet describing the "Inventum" ceiling heater.

L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2.—Leaflets, dealing with the "Universal" washer and dryer and the "De Luxe" three-heat electric heating pad, and particulars of blocks which may be loaned for local advertising of electrical gifts for Christmas; also the November issue of "The Link."

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.—The catalogue of electric lighting fittings recently issued by the company contains over 200 pages, and deals with all types of pendants, brackets, electroliers, ceiling fittings, and standards, as well as many other lighting devices. Many hundreds of illustrations are included, and no effort has been spared to bring the publication up-to-date. The work is well produced and the stiff cloth binding is made to withstand hard usage. We have also received catalogues dealing with illuminated signs (F 5,534), industrial and street lighting fittings and accessories (F 5,531), the "Gecoray" system of shop-window lighting (F 5,586), and floodlights and floodlighting (F 5,530); and a leaflet (F 5,591) on shadowless operating-theatre fittings.

MASON (ELECTRO-MEDICAL), LTD., 96, Wigmore Street, London, W.1.—A 56-page booklet describing and illustrating apparatus and appliances for every branch of electro-medical treatment.

The COOPER-STEWART ENGINEERING CO., LTD., 136-137, Long Acre, London, W.C.2.—A set of leaflets illustrated and describing the latest range of "Stewart" domestic appliances.

The BRITISH ALUMINIUM CO., LTD., Adelaide House, King William Street, London, E.C.4.—Leaflets for addition to the publication "Aluminium Facts and Figures," dealing with round rod (A 31-2), aluminium alloy rod (A 33-4), B.E.S.A. specifications (A 115), alloys (A 121-2), sheets for canning, &c. (A 159), heat treatment for castings (B 27), and forging (B 42).

CHESTERTON, JONES & CO., LTD., Tyseley, Birmingham.—Folder giving illustrations, particulars and prices of "Britalite" industrial lighting reflectors.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A conduit price list containing a simple device for ascertaining the number of wires of various sizes which can be accommodated in different-sized conduits.

LANDIS & GYR, LTD., Victoria Road, North Acton, W.3.—A series of illustrated pamphlets dealing with "Inducta" electric clocks, &c.

OSWALD RECORD & CO., 17, Victoria Street, London, S.W.1. —A leaflet illustrating the model LF3 transverse-hole current transformer for 26 kV.

ALLIANCE WHOLESALE, LTD., 62, Great Russell Street.—An illustrated leaflet giving particulars and prices of "Evercold" refrigerators.

FEED WATER SPECIALISTS CO., Maxwell House, St. Paul's Square, Liverpool.—Technical publications Nos. 26 and 27 dealing respectively with methods of estimating evaporation and measuring corrosion, &c., in boilers.

UNITED ELECTRICAL CO. (BIRMINGHAM), LTD., Coolex Works, Penn Street, Birmingham.—The "Coolex" switch and fuse gear catalogue (No. 110), with illustrations and details of new patterns of multiple switch-splitters, cooker control units and fuse splitters.

MONOLAMP, 308, Regent Street, London, W.1.—A folder illustrating an attractive range of indirect lighting fittings.

H. H. WILLIAMS, LTD., 79, Queen Victoria Street, London, E.C.4.—Catalogue of "Eltron" and "Excelda" immersion heaters, geysers, heating pads, soldering and branding irons, swivel shades, vacuum cleaners, &c.; also a copy of a special salesmanship course, offered free to dealers in the company's products.

MOUL & CO., 21, Old Queen Street, London, S.W.1.—Folder No. 80, giving particulars of a new hand tachometer with automatic change gear for six-speed ranges.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—An illustrated price list (L519) of "Mazda" gasfilled projector lamps for kinematographic, photographic, surgical, optical, stage and publicity purposes.

ENGINEERING SPECIALISTS, LTD., Craven House, 121, Kingsway, London, W.C.2.—A folder illustrating the various grades of "Vee-Reg" valves.

PREMIER ELECTRIC HEATERS, Keeley Street, Birmingham.—An excellently produced catalogue (No. 150) containing 88 pages of descriptive matter, with good illustrations, of the company's extensive range of fires, irons, kettles, hotplates, toasters, and other domestic electrical appliances. The publication is bound in a very tasteful coloured cover.

FRANK W. STURGESS, 181a, Finchley Road, London, N.W.3.—Illustrations, particulars and prices of the Sturgess thermal flashers.

FREDERICK SMITH & Co., Anaconda Works, St. Simon Street, Salford, Manchester.—A brochure relating to copper-cadmium trolley wire.

FURNACE ELECTRIC HEATING CO., LTD., 22a, Commercial Street, Halifax, Yorks.—An illustrated price list of "Furnace" electric fires, together with particulars of the easily-detached elements which are employed.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, London, W.C.2.—Leaflet 1,119 giving a description and technical details of the type 372 short-wave receiver.

JOHN T. CHALK, Bradmoor Hall, Keston, Kent.—A leaflet describing the "Chalk" double-ended water-tube boiler for marine and land installations.

The SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2.—A well-illustrated priced catalogue (No. 530) of a very wide range of electric fires and radiators.

For Sale.

The stock of electric lamps, &c., of the Sphinx Electric, Ltd., now in liquidation, is to be sold by auction on November 20th by Messrs. Frank G. Bowen, Ltd., at 4a, Lauderdale Buildings, Aldersgate Street, London, E.C.1.

A stock of electrical and wireless goods is to be sold by auction on Wednesday, November 19th, by Mr. E. Fryett at 77, Chancery Lane, London, W.C.2.

(See our advertisement pages to-day.)

Trade Announcements.

Messrs. J. H. HOLMES & CO., LTD., state that their address is now North Drive, Hebburn-on-Tyne. (Telephone: Hebburn 151; telegrams: "Holmcolim, Hebburn.")

The Z ELECTRIC LAMP & SUPPLIES CO., LTD., has opened under the management of Mr. J. Fitzgerald, branch offices and stores at 13, Rosemary Street, Bristol, from which to serve the West of England more expeditiously.

The ELECTRIC & ORDNANCE ACCESSORIES CO., LTD., has opened a London office at 110, Cannon Street, E.C.4. (Telephones: Mansion House 7211-2.)

The Belfast office of the BRITISH THOMSON-HOUSTON CO., LTD., is being moved on November 17th to 38, Queen Street, Belfast. The telephone number (Belfast 4523) is unchanged.

The address of SUPRA ELECTRIC MOTORS, LTD., is now 48, Southwark Bridge Road, S.E.1. (Telephone: Hop 7050.)

The INCINERATOR CO., LTD., has removed to Hatcham Ironworks, Pomeroy Street, New Cross, S.E.14. (Telephone: New Cross 0668.)

Messrs. JOHN BROMLEY & CO., of Wellington, Newport and Shifnal, Salop, have added an electrical engineering department to their agricultural engineering business.

MR. JOHN CASHMORE, Town Dock, Newport (Mon.), informs us that he has purchased the Birchgrove Steelworks, Swansea. These works are of recent date, and are equipped with modern and improved machinery and plant for the carrying out of structural steel contracts. In addition to the plant, there are some hundreds of tons of ironwork. The work of demolition has been commenced, and will give employment to a large number of men for some considerable time.

The telephone number of Messrs. GEORGE ELLISON, LTD., Perry Barr, Birmingham, has been changed to Birchfields 4562 (5 lines).

The JACKSON ELECTRIC STOVE CO., LTD., is opening new branch premises at 14, Britannia House, Wellington Street, Leeds (telephone: Leeds 21727), on Monday next, November 17th. The branch is in charge of Mr. H. M. Anstey, who has been sales manager in the area for some years. The premises include stores and a showroom.

Recent Contracts.

The Associated Equipment Co., Ltd., and the London General Omnibus Co., Ltd., have placed orders with Messrs. HEENAN & FROUDE, LTD., Worcester, for the heavy electrodynamometer plants found necessary for their laboratory extensions. These equipments embody the most modern details of laboratory electrodynamometer design and the larger of the two installations is capable of dealing with 200 b.h.p. at 4,000 r.p.m. Messrs. Heenan & Froude, Ltd., have also recently completed on site a laboratory electrodynamometer installation for Minerva Motors, Ltd., Antwerp, which is capable of handling 280 b.h.p. at 4,500 r.p.m. In addition to the above, Pobjoy Airmotors, Ltd., Wirral, Ches., have placed with the company a contract for the supply of a complete "Froude" wind tunnel testing plant for air-cooled aero engines. In the electrical world, recent orders include a special three-section "Heenan" enclosed-circuit air cooler, for the Thornhill station of the Yorkshire Electric Power Co.; the main contractors are the English Electric Co., Ltd., the cooler being for use with a 30,000-kW turbo-alternator. A large enclosed-circuit air cooler is also under construction for the power station at Groningen, Holland, for an Escher Wyss turbo-alternator.

WILD-BARFIELD ELECTRIC FURNACES, LTD., has received an order from manufacturers in this country for "Gibbons-Wild-Barfield" electric furnaces which it believes to be the largest ever placed in this country for resistance furnaces; two of them are the largest ever built in Great Britain, each having a capacity of 7 tons.

Book Notices.

"Anfangsgrunde der Wechselstromtechnik," by Konrad Gruhn. Pp. 82; 137 illustrations and diagrams. Dresden and Leipzig: Verlag Von Theodor Steinkopf. Price 5 marks 80 pf. (about 5s. 9d.).—This is another of the many German text books on electrical subjects and, as its title indicates, it takes the form of an elementary course of instruction in the technics of alternating current. The author, Herr Konrad Gruhn, who is connected with the Technical Teaching Institute of Dresden, explains in the preface that for the benefit of beginners he has endeavoured to deal with the subject in the most elementary manner and without resorting to the use of higher mathematics, although he points out that a certain facility in mathematics, algebra, and trigonometry as well as in ordinary electro-technical subjects is necessary if the information given in the various chapters is to be properly assimilated. The work is divided into a series of short chapters, each illustrated by diagrams; it commences with a study of the oscillograph and gradually takes the student through the whole subject to a final consideration of the resonance transformer. In addition to the usual contents, a short index is given at the end of the book by means of which reference can quickly be made to any particular part of the subject.

"Anuario del Comercio Anglo-Sudamericano" (308 pp.; ill.). London: South American Trade Journal, Ltd.—This edition of the "British-South American Trade Annual" is of particular interest in view of the approaching British Empire Trade Exhibition. It is printed in Spanish and is designed as a means of fostering trade relations with the great Latin-American Republics. Articles by a number of leading British industrialists, business men and others form the bulk of the publication; among them are "Britain's Great Electrical Industry," by Sir Hugo Hirst, Bt., "British Engineering," by Sir Gilbert Vyle, and "Wireless Telegraphy and Telephony," by the Marchese Marconi. The annual is being circulated to about 10,000 prominent business men in South America.

We have received a copy of a souvenir booklet issued at the recent inaugural ceremony in connection with the commencement of the construction of the new fish dock at Grimsby, which is being constructed by the Corporation. The L.N.E.R. Co. will pay rent for the use of the dock until the loan obtained by the Corporation has been repaid, when the company will take over the dock. The booklet contains some interesting details and illustrations of the fishing industry at Grimsby and of the existing docks with particulars of the equipment, some of which is electrically operated. The booklet is published by Messrs. W. H. Jackson & Co. (Advertising), Ltd.

"Alternating Currents," by Calvin C. Bishop. Pp. viii+317; figs. 338. London: Macmillan & Co., Ltd. Price 8s. 6d. net.

"Electric Cables," by Francis W. Main. Second edition. Pp. xii+115; figs. 35. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

"Electrolytic Damage to Gas Pipes," by H. C. Wildlake, A.M.I.E.E., A.M.Inst.GasE. London: Walter King, Ltd. Price 6d.

"The Gates of Light," by Beatrice Irwin. Pp. 160; illustrated. London: Rider & Co. Price 7s. 6d. net.

Private Arrangements.

W. J. GOOD, Westbourne Grove, Redcar, and 2, Maxwell Place, Dormanstown, electrical engineer.—At a recent meeting of creditors, a statement of affairs was submitted which showed liabilities of £1,153 (trade creditors £627) and net assets of £247, leaving a deficiency of £906. It was stated that the debtor commenced business in January, 1926, when he became a partner in an existing electrical and radio firm. Subsequently the other partners retired, and since early in 1929 the debtor had traded alone. The present position was attributed to bad trade, lack of capital, and keen competition. A resolution was passed confirming a deed of assignment already executed to Mr. C. P. Barrowcliff, Albert Road, Middlesbrough, subject to certain cash claims being withdrawn. A committee was also appointed.

Fire at G.E.C. Works.

The GENERAL ELECTRIC CO., LTD., announces that a fire occurred on November 7th at its "Magnet" Works, Landor Street, Birmingham. This works is only one of the company's factories in the Birmingham district, and does not form part of its principal manufacturing group, which is situated at Witton. The fire was confined to part of the stores, and the output of the factory has not been affected, the full complement of workpeople being employed.

How to Handle Cable Drums.

Damage is frequently caused to cable while still on the drum through carelessness or lack of method in handling the drum. To guard against this, Messrs. JOHNSON & PHILLIPS, LTD., have issued a small folder in which the proper way to roll the drum and to secure the free end is set out and illustrated by two drawings.

A New Dutch Cable Factory.

A new cable factory has been established by the Twentsche Kabelfabriek at Haaksbergen, in the province of Overyssel, and it has already delivered its first consignment of cable to the Den Ham local authority. In the course of a conversation with the representative of an Amsterdam newspaper, Mr. W. J. van der Lof, the director, is reported to have stated that Holland has hitherto only possessed one factory for turning out h.p. cables, and that this was unable fully to meet the needs of the country. During the past year, Holland imported cables of the value of 13,000,000 fl, and it was therefore not astonishing that the Dutch should endeavour to keep the business in Holland. The director considered that the new company would be able to compete with foreign firms, as it already had the advantage of a saving of 5 per cent. in import duties and 3 per cent. in transport costs. To some extent the company is dependent for raw materials upon Germany, which lies close at hand; it is said to be well supplied with orders for several months forward.

Copper Production in France.

Apart from the scheme for developing the production of electrolytic copper by the Société Electro-Métallurgie de Dives, to which reference was recently made, it is announced that the Tréfileries et Laminoirs du Havre, which is about the second largest consumer of copper in France, proposes to establish plant for the production of electrolytic copper so as to render the company independent of the policy of the copper cartel if possible. The output capacity of the proposed plant will be 30,000 tons per annum. It is stated that the American Smelting and Refining Company is in negotiation with the French company with a view to participation.

Social Events.

On Saturday last we were entertained by the "Clesco" Light Operatic and Dramatic Club of the County of London Electric Supply Co., Ltd., to the second edition of "Electric Tricks," which was presented at King George's Hall, Caroline Street, W.C., on November 6th, 7th and 8th. As in the preceding production, the revue was in a series of 24 pleasant "shocks," humorous and musical, with dramatic episodes by way of effective contrast. Messrs. W. E. Dosset and A. Ashdown were again responsible for the music and lyrics, and for the production of the revue, while Mr. V. Cox contributed additional musical numbers, the whole show being "home made." The sketches were bright and witty, while the music would have graced a professional show. The dances by the eight Electron Girls again formed a popular feature, and the staging and lighting effects were excellent. At the conclusion of the performance floral tributes were paid to the ladies.

The Henletel Swimming Club (Henley's City Office Club) held its first swimming gala at Holborn Baths, Broad Street, London, W.C., on October 31st. In addition to the usual club events, there were team races between teams representing Gravesend Works, Woolwich Works, Henley's Tyre Co., and the home club—City Office—and in both cases—ladies and gentlemen—City office proved the victors. Among the spectators were Sir Montague Hughman, Mrs. Rosling, Mr. Bishop, Mr. Anderson, Mr. and Mrs. Dunsheath, Mr. Lefeaux, Mr. and Mrs. Jacob, and large groups of supporters from Gravesend and Woolwich Works. Mr. Rosling was unable to attend through indisposition. The prizes were distributed by Mrs. Rosling.

It is a bold undertaking for any amateur society to produce a show which is practically all home-made, but the Metropolitan-Vickers Dramatic and Operatic Society returned to its old habit in this respect with "Miss Magnate," a topical musical comedy which has just completed a successful week's run at the M.-V. Club Theatre. In addition to much clever fun the show included scenes of exceptionally beautiful effect. The Club Theatre is well equipped and this, with excellent stage management and lighting effects, contributes much to the high standard of the Society's productions.

The annual staff dinner of British Insulated Cables, Ltd., was held at the Adelphi Hotel, Liverpool, on November 7th. Between seven and eight hundred people were present, and the dinner took place in two rooms simultaneously, Messrs. J. Tennant and T. Harding being in the respective chairs. According to custom, speeches were of the briefest description. In one room after the loyal toast Colonel Bates, works manager at Prescot, proposed the health of the company. The chairman of the company, responding for the company, paid high tribute to Mr. G. H. Nisbett, managing director. After dinner an admirable concert was given. There was also a whist drive of 38 tables; and the dance floor was crowded throughout the evening.

The Australian Duty on Telephone Apparatus.

At a recent inquiry into an application for increased duties on telephone and telegraph apparatus imported into Australia it was stated that the value of telephone equipment imported since 1924 was £5,392,203. Mr. L. P. Bean, managing director of Stromberg-Carlson (Australasia), Ltd., said that since 1924 the Postal Department had shrouded its contracts in secrecy, and that it was competing with private enterprise in the telephone equipment industry. Six large firms were waiting to erect factories if increased duties were granted, and his company would be in a position to make the complete telephone equipment in twelve months.

A Dutch Battery Firm in Australia.

The firm of Herberholds, of Utrecht, Holland, has made arrangements for the establishment of a factory in Melbourne for the manufacture of all classes of dry batteries: Australian capital will be employed. The local secretary of the company is Mr. J. L. Moore, Temple Court, Collins Street, Melbourne.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Nov. 11th	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¾d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£112	£3 dec.
	Grade II ... ... ,, ,,	£84	...
	Grade III ... ... ,, ,,	£51	£1 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	7⅝d.	...
c	,, Tubes (solid drawn) ... ,,	9½d. to 10d.	...
c	,, Wire, basis ... ... ,,	8d.	...
c	Copper Tubes (solid drawn) ... ,,	11d.	...
g	,, Bars (best selected) ... per ton	£73	...
g	,, Sheet ... ... ,,	£73	...
g	,, Rod ... ... ,,	£73	...
d	,, (Electrolytic) Bars ... ,,	£46 8s.	£2 15s. dec.
d	,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ... ,,	£56 8s.	£2 15s. dec.
d	,, ,, H.C. Wire per lb.	7¼d.	¼d. dec.
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	5½d.	½d. inc.
i	Iron, Pig (Cleveland No. 3.) ... per ton.	63/6	...
	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£17	5s. inc.
g	Mercury ... ... per bot.	£22 10s. to £22 12s. 6d.	2s. 6d. dec.
e	Mica (in original cases) small ... per lb.	6d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/0½d.	...
p	,, ,, rolled strip & sheet ,,	1/0½d.	...
p	,, ,, wire ... ... ,,	1/0½d.	...
o	Platinum ... ... per oz.	£7	...
d	Silicium Bronze Wire ... ... per lb.	9½d.	½d. dec.
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£112 15s. to £113 15s.	£7 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	2/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co., reporting on November 8th, stated that the lead market remained steady until November 6th, when the tone became weak, November lead declining 5s. and forward 3s. 9d. per ton, a contango of 2s. 6d. per ton being established. Considerable declarations of Mexican lead were made last week. Demand from consumers has been quieter than ever, while arrivals are excessive to actual requirements. The general position remains unchanged. Consumption continues to show a tendency to decline, while production everywhere is fully maintained.

The Timber Market.

Our Timber Trade Correspondent reports that business in European softwoods is keeping up remarkably well considering the industrial depression, but prices on the spot continue weak. Stocks for the time of year are comparatively moderate. Building contracts show an increase in total volume. For forward timber business large purchases have been made from Finland and Sweden during the past month on a lower range of prices. Logging concerns in those countries intend reducing next year's output for the U.K., which should have the effect of keeping wood values on a paying basis. The hardwoods are quiet in demand, home and Colonial woods being steady to firm, especially teak. The resumed auction sales of mahogany logs in London and Liverpool show that values have made no apparent advance on those of July last, but stocks in first hands are small. The American woods lack strength in demand and values owing to large supplies on the market, and many shippers are still eager to sell at low prices. Plywood is moving a little more freely into consumption, but values on the spot and for forward business are unsteady.

The Ex-Verity Association.

The first dinner and general meeting of this recently-formed Association, to be known as the "E.V.A.," will take place at Gatti's Restaurant, Strand, on December 4th. Ex-Verity men who are not yet members of the Association and who desire to join are asked to communicate with the acting secretary, Mr. W. M. Tribute, 229, Regent Street, W.1, who will send full particulars. The "E.V.A." has already a long list of members, but is anxious to get into touch with all who are qualified for membership.

The Closing of the Dick, Kerr Works.

The Preston correspondent of the *Manchester Guardian* states that the engineering side of the Dick, Kerr Works of the English Electric Co., Ltd., at Preston, is to be gradually closed down. "All the work now in hand will be proceeded with, but no new work will be brought in. This means that some months will elapse before the engineering works are closed altogether. The company has branches at Stafford, Rugby, and Bradford, where all the new work will go. In filling any vacancies at these other works, men displaced at Preston will be given preference. At present about 600 men and 250 girls are working, but in normal times the works employed fully 3,000 people." It is stated that the car-building works, which formerly belonged to the United Electric Car Co., Ltd., are not affected, and every effort will be made to extend this side of the business.

Lighting and Power Notes.

Australia.—Extensions in New South Wales.—The Clarence County Council and Bellingen Shire Council have made an agreement for the southern extension of the Nymboida hydro-electric scheme. The County Council will supply electricity to the whole of the shire, including the towns of Bellingen, Urunga, Fernmount and Sawtell, and many rural areas.

Aylesbury.—Meters.—The Town Council has applied for sanction to a loan of £3,000 for meters.

Ayrshire.—Year's Working.—The annual report of the Ayrshire Electricity Board (engineer and general manager: Mr. W. C. Bexon) for the year ended May 15th last shows an increase in the gross profit from £127,945 to £142,757. The total revenue rose from £234,678 to £255,376, the working expenses amounting to £112,615, as against £106,733. To the gross profit was added £3,289, balance brought forward from the previous year's account, making £146,047 available. From this the following items were paid: Loan charges, £62,859; stock and loans fund, £60,289; overdraft interest, £98; income tax, £7,422; stock issue expenses, £2,500; stamp duty on stock transfers, £1,000; depreciation and renewals, £5,289; reserve fund, £4,000. This left a credit balance of £2,589, which was carried forward. During the year the capital expended amounted to £111,308 and included £85,373 for mains; the total now spent on the undertaking is £1,878,555. The total sales of electricity sold increased from 38,569,499 to 40,035,656 kWh, although there was a slight fall in the quantity used for power and traction; the total maximum supply demanded declined from 20,400 to 17,600 kW. The average price obtained per kWh increased from 1.46d. to 1.53d. Two new 50,000-lb. boilers were put into commission during the year and helped considerably to reduce the coal costs. The total length of underground cable laid during the year, exclusive of services, was 24 miles, while 12 miles of overhead transmission lines were erected. It is anticipated that the generating station will be connected with the Grid system either at the end of the current year or in 1931.

Beckenham.—Loans.—The Urban District Council has applied for sanction to the following loans:—Plant for bulk supply, £440; meters, £1,424; fixed price limit supply, £591; cookers and apparatus, £3,643.

Bingham.—Supply to Institution.—The Notts County Council has obtained an estimate from the Derbyshire and Nottinghamshire Electric Power Co. for the extension of mains to the Bingham County Institution and the county architect has been instructed to prepare a specification for the wiring of the building.

Cheadle and Gatley.—Assisted Wiring.—We have received from Mr. R. W. Willis, electrical engineer and manager of the Urban District Council Electricity Department, a booklet giving particulars of the assisted wiring schemes in operation in the Council's supply area. Since the adoption of the schemes in January last over 200 additional consumers have been connected and applications for supplies are still being received.

Chester.—Extensions.—The borough electrical engineer has been authorised to proceed with the laying of cables and the erection of a sub-station on the Lache estate, at an estimated cost of £4,324.

Clacton-on-Sea.—Loans Sanctioned.—The Urban District Council has received sanction to loans of £12,000 for mains and services, meters, and domestic apparatus for hire.

Continental.—France.—As a result of recent negotiations the supply of electricity in the Paris area is now entirely in the hands of two groups, one consisting of the Union d'Electricité and the other of the Compagnie Parisienne de Distribution d'Electricité and the Société de l'Electricité de la Seine. In order to meet the increasing requirements the Cie. Parisienne is erecting a new generating station adjoining the already large one at St. Denis. The new plant will comprise three sets of 50,000-kW turbo-generators.

Latvia.—A German concern is reported to have submitted a scheme to the Latvian Government for the construction of a large new power station near Riga with initial and ultimate capacities of 40,000 and 70,000 kVA, respectively.

Finland.—An official report has recently been issued dealing with the position of electric power supply in Finland at the end of 1928. At that time there were 783 power stations in the country, having a total capacity of 365,028 h.p., of which 149,017 h.p. was hydro-electric, 204,818 h.p. was steam, and 11,193 h.p. internal-combustion engine operated. The output during the year in question amounted to 651½ million kWh. This has, however, since been greatly increased as part of the large hydro-electric plant on the River Imatra has been in operation since 1929.

Lettonia.—It is reported that the Government of Lettonia and the city of Riga are at present negotiating with a number of large electrical firms in regard to the proposed establishment of a power station in the vicinity of Riga. The town of Riga is already provided with an electricity supply station, but this is insufficient for modern requirements. The investigation mainly concerns the projected utilisation of water power near Dahlen, Riga. It is uncertain whether the contract will be placed by the Government, the city of Riga, or by both in common.

French West Africa.—Hydro-electric Scheme.—In the course of a D.O.T. report on economic conditions in French West Africa (Stationery Office, 1s. 6d. net) Mr. E. C. Buxton, Consul- General at Dakar, says that it is proposed to construct a hydro-electric plant at the Sotuba barrage, near Bamako, the capital of the French Sudan, at an estimated cost of 5 million francs.

Ilminster.—Inauguration of Supply.—The electricity supply for Ilminster was switched on at St. Mary's Hall on November 6th, by Mr. F. T. Adams, chairman of the Urban District Council. The supply is taken from the Bristol Corporation.

Indo-China.—Electrical Development.—A message from Hanoi says that at the annual meeting of the supreme council of economic and financial interests in Indo-China, approval was given to the programme for electrifying the Tonkin Delta and to the scheme granting the concession for the distribution of the electric power in this region to the Société Indo-chinoise d'Electricité. The plan, which is to be completed in five years, provides for an extensive system, with two large power stations at Hanoi and Haiphong linked up with each other.—*Reuter's Trade Service* (Paris).

Japan.—Hydro-electric Development.—The Lake Candidius hydro-electric power station in Taihoku, Taiwan, has met with many delays and obstacles in the last nine years, but latest indications point to a resumption of work within a few months. The Governor-General of Taiwan is reported to have instructed a large electric power company in Taihoku to seek immediate approval to a foreign loan of about £3,500,000 for this purpose.

The Showa Suirikumiai of Heian-nando, Chosen, proposes to develop 9,000 kW from water power. Tenders will shortly be invited by the Ono-gawa Hydro-Electric Co. in the Fukushima Prefecture for a 2,000-kW turbo-generator.

Leeds.—Heating of Civic Buildings.—At a recent meeting of the Corporation Finance Committee, a letter was submitted from Mr. E. Vincent Harris, architect, with respect to the heating of the new civic buildings, and it was decided that the electrical thermal storage system should be adopted.

ASSISTED WIRING SCHEME.—The Corporation Electricity Committee has obtained sanction to the borrowing of £30,000 in connection with the assisted wiring scheme.

Liverpool.—LOAN SANCTIONED.—Sanction has been received by the Town Council to a loan of £206,170 for the installation of a second 50,000-kW turbo-alternator at the Clarence Dock power station.

London.—STEPNEY.—YEAR'S WORKING.—We have received from Mr. W. C. P. Tapper, borough electrical engineer and manager, a copy of the abstract of accounts of the electricity undertaking for the year ended March 31st last. The total revenue showed an increase from £355,848 to £369,837, while there was a working expenditure of £180,092, as compared with £165,854. The gross profit amounted to £189,745 (£189,994), and after providing for loan interest, sinking fund, income tax, &c., there was a net surplus of £20,615, as compared with £47,593 in the preceding year. During the year the capital expenditure amounted to £226,427, and included £46,895 for land, £49,878 for buildings, £56,309 for machinery, and £42,486 for mains; the total now spent on the undertaking is £2,330,758. The electrical energy sold (including bulk supplies) increased by 3,728,241 kWh to 75,041,236 kWh, while the maximum load rose from 34,750 to 35,180 kW. The average price obtained per kWh fell from 1.164d. to 1.148d. New service connections added to the Council's mains during the year numbered 2,669, bringing the total at March 31st to 21,976. Further progress was made with the extension of the Limehouse generating station and with the laying of 66,000-V cables, and it is hoped that it will be possible to connect up with the Grid at an early date.

SHOREDITCH.—The Borough Council is to apply for sanction to the borrowing of £114,464 for electricity purposes.

HAMMERSMITH.—A breakdown at the power station just after 9 p.m. last Friday caused a failure of the electricity supply in a large area of Hammersmith, Chiswick and Shepherds Bush, including Olympia.

CONVERSION OF HYDRAULIC LIFTS TO ELECTRIC DRIVE.—The Central Public Health Committee of the L.C.C. recommends the expenditure of £6,200 on the conversion of the five hydraulic lifts at St. Mary's Hospital, Islington, to electric drive.

Manchester.—ELECTRICITY CHARGES WITH RENT.—A circular letter has been dispatched by the City Council to tenants of Corporation property explaining a scheme by which they may pay for their electricity by weekly instalments as part of the rent instead of quarterly as at present. The tenants are invited to vote on the scheme and if the majority is in favour the new charges will come into operation at the beginning of January.

Nottingham.—POWER STATION EXTENSIONS.—In connection with the grid scheme important additions are now being made to the plant at the Corporation's power station at North Wilford. Two new transformers are to be installed and the first of these, weighing 64 tons, arrived at Wilford last week.

Nottinghamshire.—OVERHEAD LINES.—The Derbyshire and Nottinghamshire Electric Power Co. is to erect overhead lines in the following parishes:—Edingley, Kirklington, Morton, Papplewick, Newstead, Blidworth, Fiskerton, Aslockton, Awsworth, Cossall, Barnstone, Granby, Warsop, Budby and Ollerton.

Oldham.—LOANS.—The Corporation Electricity Committee is applying for sanction to loans of £75,000 for installations; £75,000 for services; £45,000 for meters; and £15,000 for domestic appliances.

Plymouth.—PROPOSED NEW PLANT.—The Corporation Electricity Committee has decided to ask the Electricity Commissioners to review immediately the Town Council's application for sanction to a loan of £106,300 for a new turbo-alternator, &c.

Preston.—SPECIAL ORDER.—The Town Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in various towns in the urban district of Longridge and the rural districts of Preston and Garstang.

COOKER HIRE-PURCHASE SCHEME.—The Corporation Electricity Committee proposes to institute a system for the hire-purchase of electric cookers.

Sheffield.—ELECTRICAL ENGINEER TO INSPECT POWER STATION PLANT.—The Corporation Electricity Committee has authorised the general manager to visit certain works on the Continent where plant on order for the Committee is now under construction, and to inspect certain up-to-date power stations at which the most modern types of boiler equipment and appliances have been installed.

TRAMWAY SUPPLY.—Sanction has been received by the Electricity Committee to the following loans in connection with the proposed supply of electricity to the tramway system:—£2,056 for sub-station equipment and buildings; £5,975 for distribution mains; and £9,238 for plant.

MAINS EXTENSIONS.—The Electricity Committee is to extend mains at an estimated cost of £11,234.

South Africa.—JOHANNESBURG.—A net profit of £122,019 was made by the Municipal Electricity Department for the year ended June 30th last. This represents 4.93 per cent. on the capital of £2,475,895, and is the largest profit in the history of the undertaking. The plant at the Jeppe Street power station was increased by two 10,000-kW sets, bringing the capacity of the station to 30,000 kW. The electrical energy generated during the year amounted to 93,391,869 kWh.

Syria.—WATER-POWER DEVELOPMENT.—Important progress was made in the development of water resources of Syria during 1929. A hydro-electric plant on the Kadisha River, which will supply power to the city of Tripoli and environs, was completed; work was begun on a dam and hydro-electric plant on the River Orontes, to supply the towns of Homs and Hama, and a similar project was begun in the last quarter of the year at Nabh el Safa. The latter station will supply power to Beirut and a number of villages in the district. In addition, schemes are also under consideration for the establishment of hydro-electric stations on the Euphrates, Khabour, and Yarmouk Rivers.

Turton.—HIRE-PURCHASE SCHEME.—The Urban District Council has made application for sanction to the borrowing of £3,000 for the purchase of domestic appliances to be sold to consumers on hire-purchase terms. The establishment of an electricity showroom is planned for the near future.

West Hartlepool.—ELECTRICAL INSTALLATION PROGRESS.—During the six months ended September last the Corporation Electricity Department made a total of 813 new connections, as against only 79 in the corresponding period of 1929. Of these 523 were made under the free wiring scheme and 112 under the hired wiring scheme.

West Lancashire.—EXTENSIONS.—The northern part of the electricity scheme carried out by the Rural District Council was inaugurated on November 1st in the parishes of Tarleton and Hesketh Bank. The supply was switched on by Mr. Robert Latham, J.P., to whom a gold key was presented by Mr. James Scott on behalf of W. T. Henley's Telegraph Works Co., Ltd., who laid the cable. Electricity is supplied by the Lancashire Electric Power Co., and over 150 connections have been made in the district. The Council now proposes to spend £5,000 on the extension of the scheme so as to supply Rufford and Mere Brow.

West Scotland.—REVISED TARIFFS.—Several reductions in tariffs are to be introduced by the Clyde Valley Electrical Power Company under a new meter-reading system, which will affect most of the consumers in the West of Scotland. The principal points in the scheme are: The payment in advance by customers on the rental system, under 5 per cent. discount, is to be discontinued. Houses, shops and offices are to come under the same rates. The minimum charge is to be reduced from £1 13s. 4d. to £1 6s. 8d. per annum. The new "two-rate tariff" is to be 4½d. per kWh up to a fixed amount and ¾d. per kWh beyond. The rental tariff remains unchanged. The effect so far as domestic consumption is concerned will be a reduction of ½d. per kWh for electricity used in excess of the fixed amount and in the case of shops and offices a reduction of ½d. per kWh in the primary rate and ¾d. per kWh in the secondary rate. For houses, the assessment of the number of kWh to be used at the primary rate is to be determined by the number of apartments, and in the case of shops, offices, &c., assessment is to be based on the number of lamps installed.

Tramway and Railway Notes.

Australia.—MELBOURNE.—The accounts of the Melbourne Tramways Board for the year ended June 30th last show a total revenue of £2,349,154, a working expenditure of £1,658,830 and a gross profit of £690,324. The previous year's figures were: Revenue, £2,435,548; working expenses, £1,704,678; gross profit, £730,870. Interest and other charges absorbed £538,237 and a total of £403,523 was transferred to the loan redemption, renewals reserve, general reserve and sinking fund accounts; payments amounting to £118,503 were also made to the State consolidated revenue. This left a total deficiency of £169,939, which compares with a deficit of £116,875 in the preceding year. The number of passengers carried decreased from 212,848,065 to 201,721,347.

Blackpool.—YEAR'S WORKING.—The accounts of the Corporation Transport Department (manager: Mr. Charles Furness) for the year ended March 13st last show a total revenue of £308,949 and a working expenditure of £218,157, leaving a gross profit of £90,792. The figures for the preceding year were: Income, £310,770; working expenses, £223,333; gross profit, £87,437. After making provision for deficiencies on the motor omnibus account (£1,200), the Thornton Gate mineral siding (£832) and the Talbot Road transport station (£818) and adding income from other sources, there was a total of £91,737 available for distribution. Capital charges absorbed £42,170 and there was a net surplus of £49,567, as compared with £50,797 in 1928-29. The capital expenditure during the year amounted to £12,249, bringing the total now

spent on the undertaking to £1,120,613. The number of passengers carried increased from 47,194,155 to 48,096,731, but the car mileage fell from 3,476,753 to 3,467,801. The total traffic revenue per car mile fell from 21.39d. to 21.33d.

Bournemouth.—Railless Cars to be Considered.—The Corporation Tramway Committee is to investigate the railless-car system and has appointed a deputation to visit Wolverhampton at an early date for the purpose of inspecting the system in operation there.

Brighton.—Relaying of Track.—The Corporation is to relay the tramway track in Dyke Road at a cost of £3,540.

Continental.—Switzerland.—The construction of a new electric railway between St. Moritz and Maloja through Silvaplana and Silo is being contemplated.

Belgium.—The work of electrification having been completed, a service of electric trains is now being run on the local railway between Brussels (Nord) and Londerzeel.

London.—New Marble Arch Station.—The work on the construction of a new tube station at the Marble Arch, on lines similar to those at Piccadilly, has now been commenced, and is expected to be completed about the middle of 1932.

Tramway Purchase Option.—The London County Council Highways Committee recommends the Council not to exercise its right in 1931 to purchase the tramways of the Metropolitan Electric Tramways, Ltd., in Stamford Hill, Green Lanes and Seven Sisters Road. The Council would again have the right to purchase at the end of a further period of seven years.

New Zealand.—Auckland.—An extension of the tramway system from Mont Albert to Avondale will be commenced at the beginning of next year by the Transport Board.

Plymouth.—Railless Cars.—A Special Committee of the Corporation has been considering the provision of a system of railless cars in the city. Members have paid visits to Wolverhampton, Nottingham, Hastings and London, and state that they are favourably impressed by the system and that they have asked the manager to submit a report on the practicability of adopting the system on the Prince Rock and Beaumont Road sections.

Stockport.—Tramway Service to be Discontinued.—The Town Council proposes to discontinue the tramway service between Cheadle Green and Gatley and to substitute 'buses.

York.—Railless Cars.—With regard to the provision of additional transport facilities to the York City Association Football Club's ground at Fulfordgate, the Corporation Transport Committee recommends the purchase of three double-deck railless cars and the extension of the overhead system from Pavement, along Piccadilly, Fulford Road and Heslington Lane as far as the road alongside the school.

Telegraph and Telephone Notes.

G.P.O. Lines.—Cable Development.—The network of overhead telegraph and telephone wires which was a feature of big cities some 20 years ago has practically disappeared, so great has been the progress made by the G.P.O. in placing the system underground. In 1914 there were 947,392 miles of overhead cable, as compared with 1,926,743 miles of underground line. In 1920 there were 1,063,372 miles overhead, while the underground mileage had increased to 3,657,285. In the next ten years, up to March, 1930, only an additional 204,574 miles of overhead line was put up, whereas the underground mileage increased to 7,344,400.

South Africa.—Wireless Telephony.—The Association of Chambers of Commerce of South Africa passed a resolution, at its annual congress held at Lourenço Marques, requesting the Government to establish a wireless-telephone service between the Union, Great Britain, and other parts of the Empire where facilities exist. The Postmaster-General, Mr. H. J. Lenton, who was present, said that so far there had been no particular demand for such a service, but the Congress resolution would hasten matters. Mr. E. H. Howes, of Cape Town, who proposed the motion, said that in South Africa they had a beam service and superimposed on that system could be given telephony of good character.

The Telephone Service.—Automatic Growth.—More than one-fifth of the telephone stations in the Post Office system, 430,700 out of 1,911,800, were of the automatic type at the end of June. In London 168,000 out of 686,000 stations were converted at that date, and the process was progressing steadily. Of the largest cities in the country, Leeds, Sheffield, Edinburgh, and part of Manchester are working on the dial system, while of the towns with from 200,000 to 400,000 population, Bristol, Nottingham, Portsmouth, Stoke-on-Trent, and Leicester are so working; Newcastle-on-Tyne soon will be added to their number. Of the towns with 100,000 to 200,000 inhabitants, Southampton, Brighton, Middlesbrough, Dundee, Coventry, Blackburn, Burnley, Swansea, Southend-on-Sea, and Stockport have the automatic system, while smaller towns include Bath, Bedford, Blackpool, Chatham, Colchester, Cheltenham, Darlington, Exeter, Gloucester, Hartlepool, Halifax, Maidstone, Ipswich, Newport (Mon.), Oxford, Paisley, Rochdale, Southport, Walsall, Dudley, and York. There are, in addition, about 150 rural exchanges of the automatic type, serving some 2,500 subscribers; they increased by 22 during September.

The total number of telephone stations in the Post Office system on August 31st, 1930, was 1,923,406, a net increase of 7,348 on the total at the end of the previous month. Of that total, 690,400 (an increase of 2,070) were in London and 1,233,006 (an increase of 5,278) were in the provinces. Residential subscribers numbered 171,826 (increase 863) in London, and 268,058 (increase 1,472) in the provinces. Call office stations, including kiosks, increased in London by 64 to a total of 6,333, and in the provinces by 84 to 6,925. The total number of inland trunk calls dealt with in June, 1930 (the latest statistics available) was 10,116,181, an increase of 446,512 over June, 1929. Outgoing international calls numbered 44,076 and incoming international calls 47,157, increases of 1,126 and 871, respectively, over June, 1929.

International Connections.—Great Britain now leads the world in international communication, being connected with 37 countries, while all messages to and from the United States pass through this country. France, connected with 36 countries, comes next; then come Switzerland with 35, Germany with 34, Sweden with 33, and the United States with 29; even the small country of Latvia has 21 international connections. Russia is connected with only about six other countries, and at present China and Japan have no existing international telephone connections, though it is understood that preliminary arrangements have been made between Great Britain and Japan for the establishment of telephone connection in the not very distant future.

Radio Notes.

An Ambitious Relay.—International Feat.—A remarkable banquet took place on November 8th, when 11,000 employés of one company, distributed all over the world, sat down at exactly the same moment to exactly the same menu to listen to exactly the same speeches. The feast was given by the H. J. Heinz Company. In America the main banquet was held at Pittsburgh, Pennsylvania; in Great Britain banquets were held in London, Manchester, Liverpool, Bristol, Leeds, Hull, Birmingham, Edinburgh, and Glasgow; others took place simultaneously in cities in Canada, Australia, France, Germany, Spain, and Belgium. All the banquets were linked through loud-speakers by an ambitious scheme of wireless and land-line links to enable the speeches to be heard by the guests in all parts of the world. The speeches began at 1 a.m. Greenwich mean time on November 9th (8 p.m., November 8th in Pittsburgh) and were broadcast from the Pittsburgh short-wave station on 48 and 25.4 metres. From the London banquet greetings were conveyed to America by means of the trans-atlantic telephone service, which was specially cleared for the occasion. In London and the other European centres mentioned above the land lines were connected to Marconiphone installations which amplified the speeches and distributed them through loud-speakers to the assembled staffs. An idea of the total amount of amplification needed may be gathered from the fact that in London alone some six hundred people were present at the banquet and 3,500 at the American one.

Belgium.—New Organisation.—The newly-formed Institut National Belge de Radio diffusion is the central executive authority for broadcasting. M. van Soust de Borkenfeldt, the former director of Radio Belgique, has been appointed director-general of the new body.

France.—Components to be Taxed?—In addition to the proposed taxes of 5s. per crystal set and 11s. 3d. per valve set, *World-Radio* learns that the Budget proposals contain a provision to tax valves and spare parts.

New Station.—The Strasbourg-Brumath transmitter was due to be officially opened on the 11th inst.

The Cabinet has sanctioned the removal of two private broadcasting stations, Radio-Paris and Radio-Petit Parisien, from Paris to new sites in the Seine-et-Oise Department, in order to reduce the mutual interference of the Parisian stations.

Italy.—New Regulations.—The Minister for Communications has presented a Bill to Parliament which contains new regulations for the installation and use of electro-radio apparatus. The proposed new law seeks to prevent the clandestine installation of amateur stations and it is also an attempt to eliminate interference which they cause with the regular broadcasting stations.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ardrossan.—November 24th. Town Council. Various works, including electric lighting of housing scheme. Specifications, &c., from, and offers to, joint town clerks.

Australia.—MELBOURNE.—Posts and Telegraphs Department. December 2nd. Cord tags. (A.X. 10332.)* Telephone cable. (A.X. 10477.)*

January 6th. Indicators. (A.X. 10403.)* Submarine cable. (A.X. 10309.)*

January 13th. Terminal strips. (A.X. 10465.)*

February 3rd. Telephone exchange power boards. (A.X. 10466.)*

BRISBANE.—City Electric Light Co., Ltd. December 8th. Four 5,000-kVA single-phase transformers. (A.X. 10393.)*

VICTORIAN RAILWAYS COMMISSIONERS.—January 7th. Remote control circuit breakers and accessories. (A.X. 10493.)*

Dublin.—November 19th. Port and Docks Board. Electrical supplies for 12 months ending December 31st, 1931. Particulars from, and tenders to, Mr. E. H. Bailey, secretary, Port and Docks Office, Westmoreland Street.

Eccles.—November 24th. Electricity Committee. Installation of electric light and power wiring and fittings in new showroom and offices now being erected in Church Street. Specification (deposit £1 1s.) from borough electrical engineer, Electricity Works, Cawdor Street, Patricroft.

Edinburgh.—November 17th. Corporation. Electric lighting installation at Prestonfield School. Specifications, &c., from Mr. W. F. Mitchell, consulting electrical engineer, 34, St. Andrew's Square; tenders to town clerk.

Knaresborough.—Installation of electric light at Council school. Mr. H. Hall, Education Offices.

Leytonstone.—December 1st. Electrical installation at the public wash-house, Cathall Road. Particulars (deposit £2) from Mr. A. P. Howell, Town Hall.

London.—CENTRAL ELECTRICITY BOARD.—November 24th. 66,000-V and lower voltage transformers. (October 17th.)

INDIA STORE DEPARTMENT.—November 28th. Transmission telephone lines for Uhl River hydro-electric project. (November 7th.)

November 28th. Submarine telephone and telegraph paper-insulated cable. (See this issue.)

December 5th. Telephone instruments and gear for Uhl River hydro-electric project. (See this issue.)

LONDON COUNTY COUNCIL.—December 8th. Wiring and fittings for electric lighting in tenements at Ossulston estate, St. Pancras. (See this issue.)

Manchester.—November 19th. Electricity Department. Fire-extinguishing equipment for transformer chambers. (October 31st.)

Newport.—Electricity Department. A second-hand chain-grate stoker. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. December 2nd. Automatic dials. (A.X. 10294.)*

December 9th. Telephone transformers. (A.X. 10370.)*

December 10th. Switchboard cable. (A.X. 10371.)*

December 15th. Transmitters. (A.X. 10362.)*

January 19th, 1931. Electric lamps and condensers. (A.X. 10446.)*

RANGIORA.—December 3rd. Borough Council. Truck-type switchboard. (A.X. 10372.)*

PUBLIC WORKS DEPARTMENT.—January 27th, 1931. 11,000-V switchgear and metering for Mangahao power scheme. (A.X. 10373.)*

Plymouth.—November 21st. Corporation. L.p. oil-immersed switchgear. (October 31st.)

November 20th. Installation of electric lighting at the new warehouse of Messrs. Service & Co., Ltd. Particulars from, and tenders to, the architect, Mr. E. H. A. Barron, 11, The Crescent.

November 17th. Twelve accumulator cells, together with wooden stands. Particulars from the city electrical engineer, Electricity Offices, Armada Street. Tenders to the Town Clerk.

Rochdale.—December 1st. Electricity Department. A.c. single-phase prepayment meters. (October 31st.)

Salford.—November 22nd. Health Committee. Installation of electrical refrigerators at two institutions. Particulars from Medical Officer of Health, 143, Regent Road.

South Africa.—KINGWILLIAMSTOWN.—December 2nd. Municipal Council. Turbo-alternators, centrifugal pumps and switchgear. (A.X. 10353.)*

Sowerby Bridge.—November 18th. West Riding Education Committee. Electric lighting installation at Allan House Child Welfare Centre. Tenders to Mr. J. C. McGrath, clerk to the County Council, County Hall, Wakefield.

Stockton-on-Tees.—November 21st. Electricity Department. Outdoor transformers and l.p. ironclad switchgear. (See this issue.)

Tilbury.—November 24th. Urban District Council. Wiring installation of refuse destructor. (See this issue.)

Uruguay. — MONTEVIDEO.—December 5th. State Electricity Supply Works. 150,000 metres of lead-covered, rubber-insulated conductors. (A.X. 10479.)*

December 1st. 200,000 metal-filament lamps. (A.X. 10478.)*

December 9th. 450,000 metres of rubber-insulated cable and wire. (A.X. 10476.)*

Wicklow.—November 24th. Board of Health and Public Assistance. Electric lighting of District Hospital, Baltinglass. Specification to be seen on application to Dr. W. G. Lyons, medical officer. Tenders to Mr. P. W. Sheenan, secretary, Board of Health offices, Rathdrum.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bath.—City Council. Accepted:—
Installation of electric lighting at houses on the Odd Down estate.—Mr. Bentley-Hunt.

Hull.—Telephones Committee. Recommended:—
Insulators (£66).—Equipment and Engineering Co., Ltd.
Water Committee. Accepted:—
Electric lighting installation at Dunswell pumping station (£139).—C. J. W. Monson.
Education Committee. Accepted:—
Electrical installation at open-air school (£352).—Accumulator Charging Co., Ltd.
Electricity Committee. Accepted:—
Cooling tower pump (£2,935).—Drysdale & Co., Ltd.

Leeds.—Electricity Committee. Accepted:—
Three sub-station kiosks (£496).—Yorkshire Switchgear and Engineering Co., Ltd.
12 sub-station fuse panels (£175).—H. J. Fuller & Sons.
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£684); Enfield Cable Works, Ltd. (£695); Macintosh Cable Co., Ltd. (£1,050); Derby Cables, Ltd. (£1,537); Edison Swan Cables, Ltd. (£563); Croydon Cable Works, Ltd. (£3,500).
Improvements Committee. Accepted:—
Electrical work at offices and shops at The Headrow (£999).—H. H. Casse.

London.—LONDON COUNTY COUNCIL.—Highways Committee. Supply of twelve 50,000-lb. water-tube boilers for Greenwich power station:—

Yarrow & Co., Ltd.	£251,211
Stirling Boiler Co., Ltd.	269,151
(alternative)	288,556
Combustion Steam Generator, Ltd. ...	280,452
(Alternative, not in accordance with specification)	246,077
Simon-Carves, Ltd.	287,366
Babcock & Wilcox, Ltd.	287,495
John Thompson Water Tube Boilers, Ltd.	288,325
Clarke, Chapman & Co., Ltd.	289,693
Vickers Boiler Co., Ltd.	296,757

All the boiler makers who submitted tenders stated that with the size of grate specified they could guarantee a continuous load of 60,000 lb. per boiler, so that ten boilers only would give the required output of 600,000 lb. per hour. The Committee has therefore accepted, with certain modifications, so much of the tender of Yarrow & Co., Ltd., as relates to the supply of ten boilers at the reduced figure of £210,225.

Central Public Health Committee. Accepted:—
Electric bed lift at Bethnal Green Hospital (£830).—Medway's Safety Lift Co., Ltd.
Automatic cold storage plant at Queen Mary's Hospital, Sidcup (£362), Queen Mary's Hospital, Carshalton (£235), and Western Hospital (£410).—J. & E. Hall, Ltd. (Electric motors to be sublet to Higgs Motors and fans to M. W. Woods & Co.)

Overhauling and refitting generating sets at St. Luke's Hospital, Lowestoft (£292).—Harland & Wolff, Ltd.

Limerick.—County Council. Accepted :—
Installation of electrical heating appliances at the County offices.—Leonard & Co.

Ripon.—Electricity Committee. Accepted :—
Work in connection with assisted wiring scheme.—G. H. Smith & Son; Brady & Mann.

Rugby.—Town Council. Accepted :—
1,000 yd. of cable.—W. T. Henley's Telegraph Works Co., Ltd.

Uttoxeter.—Urban District Council. Accepted :—
Installation of electric lighting at the town hall.—W. T. Parker.

York.—Electricity Committee. Recommended :—
Plates for batteries at power station (£1,242).—Britannia Batteries, Ltd.

Forthcoming Events.

Cardiff Engineering Exhibition.—November 12th-22nd. Drill Hall, Cardiff.

Midland Electrical Engineers' Ball.—Friday, November 14th. Grand Hotel, Birmingham.

Junior Institution of Engineers.—Friday, November 14th. Institution, 39, Victoria Street, S.W. 7.30 p.m. Annual general meeting.

Society of Chemical Industry.—Friday, November 14th. Joint meeting with the Newcastle Section. 3.50 p.m. Visit to the Carville power station of the Newcastle-upon-Tyne Electric Supply Co. 6.30 p.m. Armstrong College, Newcastle. "Caustic Embrittlement." Mr. W. S. Coates.

Illuminating Engineering Society.—Friday, November 14th. Royal Society of Arts, John Street, Adelphi, W.C. 6.30 p.m. "The Lighting of Offices and Public Buildings." Mr. J. A. Macintyre. Tuesday, November 18th. 5 p.m. Visit to view stores of Messrs. Gamages (West End), Ltd.

Association of Supervising Electrical Engineers.—Tuesday, November 18th. Junior Institution of Engineers, London. 7.15 p.m. "Modern Electric Traction." Mr. R. Brooks.

Paisley Association of Electrical Engineers.—Tuesday, November 18th. Y.M.C.A. Board Room, Paisley. 7.30 p.m. "Power Factor Correction." Mr. H. Ferguson.

Institution of Civil Engineers.—Tuesday, November 18th. Institution, Great George Street, S.W. 6 p.m. "The Lochaber Water-power Scheme." Mr. W. Thomson Halcrow.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, November 18th. Institution, Glasgow. 7.30 p.m. "The Turbo-Compressor as Supercharger." Mr. J. Holmes.

Overhead Lines Association.—Wednesday, November 19th. Institution of Electrical Engineers, London. 5.30 p.m. "Some Economic Reflections on Power Supply Transmission." Mr. A. G. Collis.

British Electrical and Allied Manufacturers' Association.—Wednesday, November 19th. Connaught Rooms, Great Queen Street, W.C. 7 for 7.30 p.m. Annual dinner.

British Institute of Radiology.—Thursday, November 20th. 8.30 p.m. Papers, including "An X-ray Generator with a Rotating Water-cooled Target." Mr. A. Müller.

Institution of Electrical Engineers.—Thursday, November 20th. Institution, Savoy Place, Victoria Embankment, W.C. 6 p.m. "Some Data Concerning Railway Electrification." Mr. G. Bianchi.

(Mersey and North Wales (Liverpool) Centre.)—Monday, November 17th. Laboratories of Applied Electricity, The University, Liverpool. 7 p.m. Joint meeting with the Liverpool Engineering Society. "Television." Mr. J. J. Denton. Wednesday, November 19th. The Temple, Dale Street, Liverpool. 6.30 p.m. Joint meeting with the Liverpool Engineering Society. "Electrification of Runcorn and District." Mr. J. E. Nelson.

(Scottish Centre.)—Tuesday, November 18th. Central Station Hotel, Glasgow. 6.30 for 7 p.m. Annual dinner.

(Scottish Students' Section).—Tuesday, November 18th. Heriot Watt College, Edinburgh. 7.15 p.m. Chairman's address. Wednesday, November 19th. Royal Technical College, Glasgow. 7.30 p.m. Chairman's address.

(North-Western Centre Students' Section).—Tuesday, November 18th. Engineers' Club, Manchester. 7.15 p.m. Joint debate with the Institution of Mechanical Engineers (Graduate Section).

(East Midland Sub-Centre).—Tuesday, November 18th. The College, Loughborough. 6.45 p.m. Address by Mr. G. Rogers, chairman of the South Midland Centre.

(Sheffield Sub-Centre).—Wednesday, November 19th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Some Automatic Electric Control Gear Problems." Messrs. H. Coates and H. J. Norballe.

(North-Eastern Students' Section).—Friday, November 21st. Grand Assembly Rooms, Newcastle-upon-Tyne. Annual dinner.

(Meter and Instrument Section).—Friday, November 21st. Florence Restaurant, Rupert Street, W. 6.45 for 7 p.m. Annual dinner.

(London Students' Section).—Wednesday, November 19th. 2.30 p.m. Visit to British Electric Transformer Co., Ltd. 8 p.m. Victoria Halls, Southampton Row, W.C. Dance.

British Electrical Development Association.—Friday, November 21st. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. Sales conference. "Electricity and the Public Mind." Mr. G. S. Francis.

Birmingham Electric Club.—Friday, November 21st. Grand Hotel, Birmingham. 7 p.m. "Power Factor Correcting Machines—Commutating Type." Mr. H. Dreghorn.

Institution of Mechanical Engineers.—Friday, November 21st. Institution, Storey's Gate. 6 p.m. "The Co-efficient of Heat Transfer from Tube to Water in Surface Condensers." Messrs. A. Eagle and R. M. Ferguson.

Electrical Power Engineers' Association (West Yorks. Section).—Saturday, November 22nd. Metropole Hotel, Leeds. 5.30 for 6 p.m. Annual dinner and dance.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices :—

VELLUMOID leather preparation for washers.
GEISSLER tubes.

Notes.

All Electric Street Lighting.

We are informed by Major C. B. Grace, engineer and manager, the Weald Electricity Supply Co., Ltd., that the following places should be added to the list of towns whose street lighting is all electric, given on page 783 of the ELECTRICAL REVIEW of November 7th :—Wadhurst, Ticehurst, Paddock Wood, Horsmonden, Heathfield, and Crowborough. Four other towns mentioned in the list referred to, *viz.*, Cranbrook, Frant, Hawkhurst, and Tenterden, are also in the area of the same company.

I.M.E.A. Convention, 1931.

It is now officially announced that next year's convention will be held at Scarborough from June 15th to 20th.

Industrial Welfare Society.

The Duke of York presided on October 31st at the annual general meeting of the Industrial Welfare Society (Incorporated). In the course of his presidential address, His Royal Highness said that their membership continued to be good, the demands made upon the staff for help and advice did not grow less, the conferences had been well attended, and public interest in their work had not diminished. There were no signs in the annual report that these depressing times had diminished in any way the value of the welfare movement. Industry must prepare to take advantage of whatever opportunity the future might bring. It must eliminate waste of time, of labour, of brain power, and this could only be done by adopting new methods and enlisting new aids.

Discontinuance of Electricity Meter Rentals.

In the leading columns of the ELECTRICAL REVIEW of October 24th reference was made to the authority given by the Electric Lighting Acts to supply undertakings to charge a consumer a minimum sum in respect of current purchased, and also a rental for the use of the meter. The minimum charge ensures that some small return is obtained on the capital incurred in giving supply to the individual consumer, and the meter rental enables the supply authority to recover part of the cost of the highly technical organisation necessary to maintain meters within the prescribed margin of accuracy. In April last the North Metropolitan Electric Power Supply Co. decided, in the interests of the small consumer, to forego the minimum charge. Although the concession was welcomed, it appeared that the meter rental was a source of irritation to some consumers, and the company now announces that meter rentals will be generally discontinued.

In making this substantial concession in continuance of its policy to reduce the cost of electricity whenever the financial position makes this practicable, it is understood that the company's decision will in no way affect its existing methods of dealing with meters. All meters before issue to

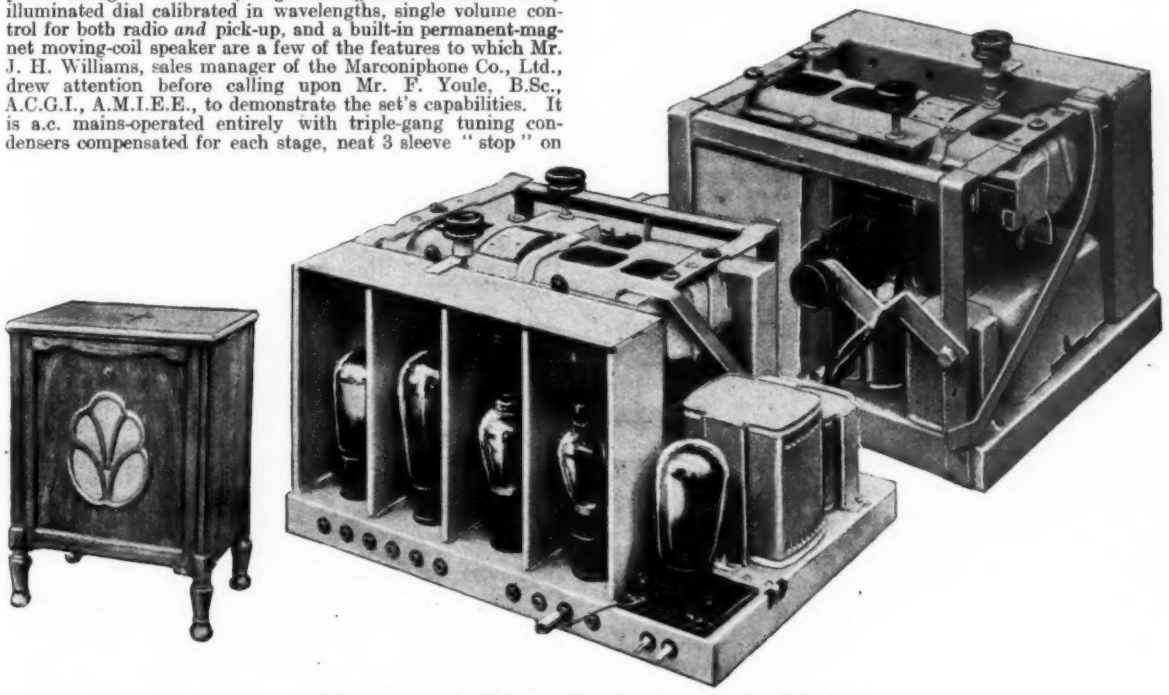
consumers will be tested in the Northmet Company's laboratory, where the maximum error allowed is less than half the statutory figure, and all meters in use will be called in for complete overhaul and recalibration at regular intervals.

Fatality.

Alexander Abbott received a fatal electric shock on November 7th at the power station of the Glasgow Corporation at Dalmarnock where he was employed. Abbott was engaged as a screenman, and while he was on the top of a condenser in the transformer house he apparently came into contact with a "live" wire of 20,000 V. The current was switched off, but the man was found to be dead, having received severe burns.

A Marconiphone Demonstration.

Model 560, which formed the subject of an evening's demonstration last week, exemplifies in a definite manner the application of engineering principles to the production of modern radio-telephone reproducers. The pressed-steel chassis whose rigidity is reinforced by girder construction, untarnishable cadmium plating, accessibility of all components and wiring, quick-release coils and screening boxes, single radio-gramophone change-over switch, single tuning control with a clearly illuminated dial calibrated in wavelengths, single volume control for both radio *and* pick-up, and a built-in permanent-magnet moving-coil speaker are a few of the features to which Mr. J. H. Williams, sales manager of the Marconiphone Co., Ltd., drew attention before calling upon Mr. F. Youle, B.Sc., A.C.G.I., A.M.I.E.E., to demonstrate the set's capabilities. It is a.c. mains-operated entirely with triple-gang tuning condensers compensated for each stage, neat 3 sleeve "stop" on the driving shaft and calibrated on the same shaft as the vanes. When used for radio, one half the dual volume control drops the volts from the screen grids of the h.f. valves to the cathodes and, in addition, automatically introduces a reaction effect after it has been turned a certain amount. When used for pick-up, the other half of the control slides the grid away from earth along a resistance to the pick-up lead. The combined wave-change, pick-up, and main switch is on one shaft with cam and tappet action of contacts for h.f circuits, and a main voltage-adjusting device consisting of a simple screw and marked sockets. Provision is made for extra loud-speakers, remote volume control, and spare fuses. The set, see accompanying illustrations, is designed to give a varied choice of programmes at loud-speaker strength, without any aerial either inside or outside the cabinet.



Views of the Model 560 Marconiphone Radio Receiver.

Large Diesel Engine.

The construction of a Burmeister and Wain double-acting two-stroke engine designed to develop 18,500 b.h.p. at full load, with a continuous overload of 22,500 b.h.p. when coupled to an alternator, for installation in the electric power station at Copenhagen, says the *Motor Ship*, is of very considerable interest. It is designed to develop the power in question at the moderate speed of 115 r.p.m., and its manufacture for such vital service is sufficient indication of the feasibility of building such high-powered units. The output is the highest of any Diesel engine yet built, the 15,000-b.h.p. double-acting two-stroke M.A.N. engine of the Hamburg power station being at present the largest oil engine in existence

Reservoirs (Safety Provisions) Act, 1930.

This Act, which comes into force on January 1st next, requires the employment of qualified civil engineers to design and supervise the construction of large reservoirs and to make periodical inspections of them. An engineer will not be accepted as qualified to carry out this work for the purpose of the Act unless he is a member of the appropriate panel of civil engineers to be set up under the Act by the Secretary of State acting in conjunction with the Minister of Health and the Department of Health for Scotland. It is contemplated that there will be two panels, one limited to engineers fitted by their personal qualifications and experience to design and supervise the construction or alteration of large reservoirs, and a second to which any engineer qualified to make the periodical inspections and reports required under the Act may be appointed. Engineers desiring to be placed on the panels should apply in writing to the Under-Secretary of State, Home Office, Whitehall, London, S.W.1, giving full particulars (in triplicate).

E.P.E.A. National Technical Groups.

MANCHESTER LOCAL GROUP.—Meetings of this Group are generally held in the Geographical Hall, St. Mary's Parsonage, near Deansgate, Manchester, and commence at 7.15 p.m. November 19th, 1930, "Protective Gear," by N. M. Kaufmann; December 17th, 1930, "Studying the Industrial User," by W. E. Swales; January 14th, 1931, "The Life and Work of Dr. S. Z. de Ferranti" (at Manchester College of Technology) by Frank Bailey.

BIRMINGHAM LOCAL GROUP.—November 26th, 1930, at 7.30 p.m., "Laying, Jointing, and Testing of 33-kV Cables," by H. J. Cox, at the Engineering and Scientific Club, Queen Street, Wolverhampton; January 21st, 1931, at 7.30 p.m., "The Construction and Efficiency of Concrete Cooling Towers," by T. J. Gueritte at the Chamber of Commerce, New Street, Birmingham.

GLASGOW SECTION.—November 28th, 1930, annual general meeting; December 12th, 1930: "Modern Steam Generators," by P. E. Rycroft. January 16th, 1931: "Hewittic Rectifiers"; February 13th, 1931: business meeting; March 13th, 1931: "Cable Manufacture," by G. H. Herbert; April 10th, 1931: business meeting; May 8th, 1931: business meeting.

PETERBOROUGH SUB-SECTION.—November 22nd, "Modern Steam Generators," by P. E. Rycroft, O.B.E., to be given at Peterborough.

SOUTH WALES SECTION.—January 9th, 1931, "Main Transmission Systems of the Central Electricity Board," by J. D. Peattie, at the South Wales Institute of Engineers, Park Place, Cardiff, at 7.30 p.m.

Heating-element Failures.

In a leaflet recently issued by Steatite & Porcelain Products, Ltd., an interesting account is given of researches by Steatit-Magnesia A.G., Berlin, into the causes which bring about the destruction of the nickel-chrome and other resistance wires used for electrical heating. Both chemical and electrical phenomena have been found to contribute to the production of the well-known coloured deposits and to the local overheating which causes the melting of the wire. Some surprising facts have been established, such as the formation of chromium-trioxide by purely thermal reactions, and the migration of the oxide mist so formed in the electrical field. The application of ceramic materials permit of great variety in shape and design, and ensures sufficient refractory qualities. Such heat-

ing elements, however, often burn out under the most unexpected conditions, and in a quite incalculable way. The opinion has been expressed that the ceramic material attacks the heating wire under the influence of the electric current, or is itself ruptured electrically owing to the diminution in its dielectric strength on heating. The occurrence of coloured deposits on the ceramic carriers is attributed to electrolytic action between the ceramic material and the wire. Arising from this belief, great importance has been attached to the insulating qualities of the material at high temperature, and the opinion has been formed that the smaller the shunt currents flowing through the carrier itself when heated, the more reliable is the material for the purpose.

The general conclusions drawn from the tests are as follows: The well-known burning out of heating elements, a frequent source of trouble, is caused by the wire. Heating wires must obviously be treated much more carefully and considerately than is generally the case. The coloured deposits occurring so extensively without the chemical or electrolytic co-operation of the ceramic material serve as a proof that overheating has taken place. Where it is a question of the supply of radiating heat, a glowing temperature of 900 deg. C. should be sufficient, and resistance wires and strips heated to much lower temperatures should be employed where only low-temperature heating is required. If an arc occurs on the burning out of the heating wire, the ceramic element is also injured by the action of the oxides. The actual conductivity at high temperature of the ceramic material has much less importance than has hitherto been assumed. An exact determination of the conductivity figure is difficult, for it is still not known what proportion of the current in these ceramic materials is carried, respectively, by electrolytic and electronic conductivity. As before, the ceramic industry still has the problem of supplying a material suitable for all purposes, resistant to changes of temperature, and which will not break under specified conditions. It should be remembered that the question of resistance to temperature change is on the one hand a question of material, and on the other one of design. In the more difficult cases, therefore, it is necessary for the designer and the ceramic expert to co-operate. It should again be stated at this point that the shape of the ceramic part has a considerable bearing on its durability. It seems unlikely that any one ceramic body will be found to be suitable for all types of resistance-wire carriers, but that a number of bodies, each specially suitable for one range of service, must be devised.

Standard for Dry Cells.

A revised national standard for dry cells and batteries, setting up authoritative specifications for materials, workmanship, performance, sizes, and markings, has just been approved by the American Standards Association. This standard covers the dry cells and batteries for wireless, telephone, ignition, flashlight, and other uses, and an important part of the standard is the section devoted to methods of test which will determine compliance with the specifications. To assure satisfactory service under various requirements the standard provides for heavy-load intermittent tests, light-load intermittent tests, continuous tests, and delayed service tests of 3, 6, and 9 months' duration.

Appointments Vacant.

Sales representative for the Hotpoint Electric Appliance Co., Ltd.

Consumers' clerk for the West Midlands Joint Electricity Authority.

Overhead line superintendent for Derby Tramways and Transport Committee.

Assistant signal and telegraph engineer for the Federated Malay States Government Railway.

(See our advertisement pages to-day.)

A New Insulating Rubber.

Announcement is made by the United States Bureau of Standards of the development of a new method of vulcanising rubber which should give the latter substance great advantages as an insulating agent. Instead of using sulphur as the vulcanising agent, trinitrobenzine is employed, producing a compound which does not tarnish copper, silver and mercury. When trinitrobenzine rubber is vulcanised in contact with copper, not only does the metal remain bright, but the ageing qualities of the rubber are practically unaffected, quite contrary to the result obtained with sulphur-vulcanised rubber under similar circumstances. It is pointed out that trinitrobenzine rubber may find an important application in the manufacture of electrical insulation on account of the fact that it may be applied directly to copper without the necessity for tinning the metal.

New Radiographic Society.

Dr. Chalmers Watson, presiding at the first meeting of the newly-formed Scottish Radiographic Society at the Edinburgh Royal Infirmary on October 14th, said that in its own sphere of activity there was good reason for thinking that the new Scottish Society would be able to contribute fresh facts of value for extending the knowledge of radiation as a curative agent. Dr. Hope Fowler, in an address on "The Evolution of Radiology," said that radiology had taken a very definite and unassailable position as a powerful weapon in the warfare against disease, more especially those forms of growth popularly called malignant. He stressed the importance of deep therapy, or highly-penetrative X-rays, "the first cousin of radium," and enumerated some of the advantages of this form of treatment.

A New Ultra-violet Lamp.

A new type of ultra-violet lamp said to have been produced in the United States of America appears to have considerable advantages. Consuming only 25 watts, it produces a very mild sunburn or redness of the skin at about 5 inches from the lamp for a period of 15 or 20 minutes. Since these lamps will probably be inserted in ordinary lighting fixtures, and used at greater distances than that mentioned, they can be left burning all day, it is claimed, without fear of imparting anything more than a mild tan. The principle of the new lamp is based on the fact that when a special oxide is used to conduct current, in a bulb containing a certain vapour, a glow discharge occurs through the vapour and fills the entire bulb; this discharge produces ultra-violet rays. The new lamp resembles the incandescent lamp very closely in size and appearance, except for its internal construction and its peculiar glow.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

At the ordinary meeting of the Institution of Electrical Engineers to be held on Thursday next, an oil painting of **Ampère** will be presented to the Institution on behalf of **Mr. E. Garcke.** The portrait is the work of Mr. Edgard Maxence, Membre de l'Institut de France.

Mr. John E. Hyder, who has been chief electrician to Messrs. Thomas Illingworth & Co., Ltd., for 11 years, has been appointed to a similar position with the Rajar Co., Mobberley, Cheshire. He asks for manufacturers' catalogues, &c.

Mr. P. F. Allan has severed his connection with the Macintosh Cable Co., Ltd., and his address is now c/o British Insulated Cables, Ltd., Prescot, Lancs.

Sir William Noble, M.I.E.E., has been appointed to the National Committee of Investigation under the Coal Mines Act, 1930, as a consumers' representative.

Mr. F. C. Zula-Crosse, formerly of Berlin, notifies us that his address is now c/o the Morgan Crucible Co., Ltd., Battersea, London, S.W.11.

Mr. G. F. Nayler, electrical and tramway engineer of Nelson, Lancs., was recently asked to resign by the local Electricity Committee, as we reported in our last issue. The Committee's action was approved by the Town Council on Monday last. The reason for the Committee's action, as reported in the *Manchester Guardian*, was that, while **Mr.** Nayler was in receipt of £100 per annum to cover the cost of running, cleaning and repairing his car, he had it maintained in condition by the Omnibus Department, from which he also obtained petrol which had not been fully paid for.

Mr. Thomas Reginald Warren, M.A., (Cantab) B.Sc. (Eng. Lond.), A.M.I.E.E., has been appointed technical assistant to Mr. D. Maxwell Buist, M.I.E.E., engineer for the Central Electricity Board in North-East England. Mr. Warren takes up his duties on November 17th. He obtained his practical training as a Faraday House student, with Messrs. Robey and Co., Ltd., Lincoln, the Sheffield Corporation Electric Supply Department, and Messrs. A. Reyrolle & Co., Ltd. He rejoined Messrs. Reyrolle as an assistant in the Technical Research Department in 1926, but vacated that post in the following year to become chief technical assistant in the Electrical Department of Synthetic Ammonia and Nitrates, Ltd. In January of this year he left to join the Metropolitan-Vickers Electrical Co., Ltd. Mr. Warren has specialised in problems in connection with the operation of power systems and is the holder of numerous patents taken out at Reyrolle's and at Billingham in connection with automatic frequency control, automatic, steam-pressure regulation, automatic, synchronising, &c.

Mr. W. Marsh, the Brighton tramway engineer was censured by the Town Council on Monday last for relaying track without consulting the borough surveyor. A motion to reduce his salary by £100 per annum was dropped after several members had expressed their appreciation of Mr. Marsh's services.

Mr. H. G. Fraser, whose portrait is reproduced herewith, is this session's chairman of the North Midland Centre of the Institution of Electrical Engineers. Mr. Fraser commenced his career as an apprentice to the Stockport borough electrical engineer and he was a student at the Manchester School of Technology. After service in the electricity departments of the Leigh and Blackburn Corporations, he went, in 1912, to Wakefield Corporation as power station superintendent. He held a commission in the Territorial Army (4th Battalion, K.O.Y.L.I.) and on the outbreak of the war was mobilised with his unit. He went to France in 1915 and served with the infantry during the whole of the war, gaining the M.C. during the Battle of the Somme, 1916. After the Armistice he proceeded to Germany with the Army of Occupation and was demobilised with the rank of major in 1919. He then returned to Wakefield as chief assistant electrical engineer and became city electrical engineer in 1920. Mr. Fraser is hon. secretary of the Mid East Centre of the I.M.E.A., and has served for some years on District Council (No. 2) for the Electricity Supply Industry.

Mr. H. G. Fraser.

Chairman of the North Midland Centre of the I.E.E.

Mr. C. T. Allan, who has occupied the position of honorary secretary of the Western Centre of the Institution of Electrical Engineers since its formation fifteen years ago, has resigned that office. Mr. H. R. Bessant, of Bristol, who has been acting as assistant honorary secretary, has been appointed to succeed Mr. Allan. Mr. Allan is assistant chief engineer and general manager of the South Wales Power Distribution Company. At the meeting of the Western Centre held on Monday last week, the chairman, Mr. E. G. Okell, of Plymouth, and a number of other leading members, expressed their high appreciation of the splendid and untiring services rendered by Mr. Allan during the lengthy period mentioned. It was decided to present him with an appreciation engrossed on vellum.

Mr. John Lennox, chief electrician to Glenfield & Kennedy, Ltd., who has retired after 41 years' service with the company, has been presented with a writing bureau, together with a crystal vase for his wife.

Mr. H. C. I. Rogers, of Brecknell, Munro & Rogers (1928), Ltd., Bristol, was married to Miss Iris M. Seymour, of Sherborne, on November 4th. The bridegroom received from his company's staff and employés a chiming oak clock and from the directors a silver coffee service.

Mr. H. G. Brown, deputy-chairman, and **Lord Southborough,** a director, of the Westinghouse Brake and Saxby Signal Co., Ltd., were present at the dedication of a memorial to George Westinghouse in Schenley Park, Pittsburgh, on October 6th.

Major S. A. Laird, who has relinquished the post of London sales supervisor to Philips Lamps, Ltd., to take up a similar position with the Edison Swan Electric Co., Ltd., was recently presented by the outside representatives and staff of Philips's London sales department with an inscribed silver cigarette case.

Mr. George Paton, A.M.I.E.E., has been appointed managing director of the Electrical Trading Association, Ltd., whose registration is recorded in the "New Companies" section of this issue. Mr. Paton has been assistant to the manager of the Radio Department of the British Thomson-Houston Co., Ltd., for 6½ years, and a member of several committees of the B.R.V.M.A. and R.M.A.

Alderman J. Hughes, chairman of the Wallasey Electricity Committee for the last seven years, has been elected mayor of the county borough for the ensuing year. He is retaining his chairmanship during his term of office.

Obituary.

Mr. J. A. Goodall.—There was a large gathering at the funeral at Plymouth on November 4th of Mr. J. A. Goodall, consumers' engineer, Plymouth Electricity Department, whose death was reported in our last issue. Among those present were Messrs. Illingworth (deputy city electrical engineer), J. Thompson (Prince Rock power station superintendent), P. Heath and V. Pope (representing Messrs. Heath & Co.), T. Hudson (W. T. Henley's Telegraph Works Co., Ltd.), J. Cragreen (Metro-Vick Supplies), J. Southwood and G. French (Southwood & Co.), W. Turner (General Electric Co., Ltd.), C. Westlake (Electrical Contractors' Association), T. Brewer (E.D.A. Circle), H. V. Channon (N.R.E.I.C.), J. W. Penrose (Penrose & Son), and T. Wise (Wise & Co.), in addition to about sixty members of the staff of the Corporation Electricity Department. The wreaths included one from the Devon and Cornwall section of the Electric Power Engineers' Association, one from British Insulated Cables, Ltd., and one from the Plymouth branch of the Electrical Association for Women.

Mr. T. B. W. Pitt-Chambers.—A cablegram has been received from the Kolar Gold Field Electricity Department announcing the sudden death of Mr. T. B. W. Pitt-Chambers, assistant electrical engineer, on November 3rd, from heart failure.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Kinsman, Ltd.—Private company. Registered November 10th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of electrical, mechanical and motor engineers, electricians, &c. The directors are:—H. W. Chapman, 207, Northfield Road, King's Norton; W. J. Parkins, "Two Pots," Romsley, near Birmingham. Registered office: Kinsman Works, Bond Street, Stirchley.

Vividad Holdings, Ltd.—Private company. Registered November 6th. Capital, £5,500 in 5,000 7 per cent. cumulative preference shares of £1 each and 10,000 ordinary shares of 1s. each. Objects: To acquire any invention relating to any form of poster and other advertising, and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in all kinds of electrical apparatus, particularly apparatus connected with electric sign and poster advertising, &c. The directors are: Sir Arthur du Cros, Bt., George du Cros and E. W. Lean, all of Grand Buildings, Trafalgar Square, W.C.2; Dr. Leonard A. Levy, 31, Shoot-up Hill, Cricklewood, N.W.2; A. Barclay, 15, Caroline Street, W.C.2. Solicitors: Steadman Van Praagh & Gaylor, 4, Old Burlington Street, W.1.

Vividad, Ltd.—Private company. Registered November 6th. Capital, £7,000 in 5,000 7 per cent. cumulative preference shares of £1 each and 4,000 ordinary shares of 10s. each. Objects: To acquire patents, and to carry on the business of manufacturers of and dealers in all kinds of electrical apparatus, particularly apparatus connected with electric signs and poster advertising, &c., and to adopt an agreement with Vividad Holdings, Ltd. The directors and solicitors are the same as those of Vividad Holdings, Ltd.

Electrical Trading Association, Ltd.—Private company. Registered November 4th. Capital, £10,000 in £1 shares. Objects: To carry on the business of electricians, electrical and wireless engineers, &c. The subscribers are: F. W. Edmonds, and S. Disborough, 18, Austin Friars, E.C.2., solicitor's clerks. Solicitors: Slaughter & May, 18, Austin Friars, E.C.

World's Wireless (Manufacturers), Ltd.—Private company. Registered October 31st. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers, and wholesale and retail dealers in radio apparatus, accessories, &c. The permanent directors are: R. Summers, 599, High Road, Leyton, wireless engineer; A. W. Taylor, Linda Cottage, New Road, Ascot, electrical engineer. Registered office: 599, High Road, Leyton.

Hedin, Ltd.—Private company. Registered November 3rd. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical heating apparatus and appliances and component parts thereof, electrical, mechanical and other manufacturers and engineers, &c. The first directors are: K. Hedin, "Woodside," Knighton Lane, Buckhurst Hill, electrical engineer; A. F. J. Wright, "Hillside," Churchfields, Woodford, mechanical engineer.

Scophony, Ltd.—Private company. Registered November 3rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in equipment or apparatus for use in connection with recording, producing, reproducing, transmitting and receiving by electrical, photographic, magnetic, or any other means, sounds, images, signals, &c. The subscribers are: A. Fletcher, 31, Princes Court, Wembley, Middlesex, solicitor; H. Sheppard, 116, Canterbury Road, Leyton, E.10, solicitor's clerk. Secretary: A. Fletcher. Registered office: 1, Finsbury Square, E.C.2.

Whiteley Electrical Radio Co., Ltd.—Private company. Registered November 1st. Capital, £1,000 in £1 shares. Objects: To carry on the business of mechanical and consulting engineers, manufacturers of and dealers in telegraphic, telephonic and wireless instruments, &c. The directors are: A. H. Whiteley, 100, Forest Road, Mansfield, and G. J. George, 3, Stella Street, Mansfield, mechanical engineers. Registered office: Radio Works, Nottingham Road, Mansfield, Notts.

Haslingden Radio Relay Co., Ltd.—Private company. Registered November 3rd. Capital, £100 in 6s. 8d. shares. Objects: To carry on the business of wireless and general electrical and mechanical engineers and contractors, manufacturers of and dealers in electrical, magnetic, galvanic and other apparatus for use in connection with radio, &c. The directors are: J. Moran, 32, Manchester Road, Haslingden, and F. Nuttall, 1, Pleasant Street, Haslingden, electrical engineers, and C. T. Rawlinson, 22, Manchester Road, Haslingden, musical instrument dealer. Solicitors: Evans & Cotton, Haslingden.

Skipton Wireless Service Co., Ltd.—Private company. Registered November 3rd. Capital, £500 in £1 shares. Objects: To carry on and promote the business of relaying by wire wireless signals, television transmission, &c. The first directors are: Mrs. M. Cason and J. Cason, 45, Russell Street, Skipton; and J. D. Waller, 51, Park View, Skipton Road, Ilkley, electrician (all permanent). Registered office: 43, Russell Street, Skipton, Yorks.

Melectric Co., Ltd.—Private company. Registered November 3rd. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, &c. The directors are: R. H. Gillespie, Cranbourn Mansions, Cranbourn Street, W.C.2; A. H. Lowe, 2, Fernshaw Close, Chelsea, S.W.10; S. H. Munro, 207, Rickmansworth Road, Watford, Herts. Secretary: J. W. Davison. Registered office: Cranbourn Mansions, Cranbourn Street, W.C.2.

Official Returns of Electrical Companies.

General Electric Co., Ltd.—Particulars filed of £3,500,000 debenture stock and premium of 5 per cent. in certain events, authorised September 11th and covered by trust deed dated October 14th, 1930, the whole amount being now issued. Property charged: Properties in Witton, Birmingham, Salford, Stoke (Warwick), Erith, Hammersmith, Harrow, Aston (Birmingham), and Kingsway, W.C., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Midland Bank Executor and Trustee Co., Ltd.

Pullars Electric Co. (Brighton), Ltd.—Further charge on properties in Brighton, dated October 23rd, 1930, to secure £200 and further advances. Holder: R. Kelsey, 4, Third Avenue, Hove.

Young, Osmond & Young, Ltd.—Deposit on October 23rd, 1930, of deeds of land and works at Welwyn Garden City, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £12,000.

Cray Installations, Ltd.—H. E. Clark, 3 and 4, Clements Inn, W.C.2, ceased to act as receiver on September 18th, 1930.

Tredegars, Ltd. (formerly Tredegars (1923), Ltd.).—H. Baker, 4, Broad Street Place, E.C.2, was appointed receiver and manager on October 27th, 1930, under powers contained in debentures dated April 24th, 1925.

Bungay Gas and Electricity Co., Ltd.—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. Return dated June 16th, 1930. 1,792 preference and 7,747 ordinary shares taken up. £4,213 paid on 1,792 preference and 2,421 ordinary shares. £5,326 considered as paid on 5,326 ordinary shares. Mortgages and charges, £8,450.

Sydney S. Bird & Sons, Ltd.—Capital, £2,500 in £1 shares. Return dated June 9th, 1930. All shares taken up. £2 paid. £2,498 considered as paid. Mortgages and charges, nil.

Frederick Victor, Ltd.—Capital, £500 in £1 shares. Return dated June 21st, 1930. All shares taken up. £500 paid. Mortgages and charges, nil.

Beam, Ltd.—Capital, £5,000 in £1 shares. Return dated April 14th (filed October 20th), 1930. 603 shares taken up. £303 paid. £300 considered as paid. Mortgages and charges, nil.

Economic Electric Co. (Liverpool), Ltd.—Capital, £10,000 in £1 shares. Return dated July 22nd, 1930. 8,300 shares taken up. £8,300 considered as paid. Mortgages and charges, £3,688 (bank fluctuating overdraft).

A. Berkeley, Ltd.—Capital, £10,000 in £1 shares. Return dated August 1st, 1930. 7,800 shares taken up. £7,800 paid. Mortgages and charges, nil.

British Electrical Instruments, Ltd.—J. W. Shepherd, 78, King Street, Manchester, ceased to act as receiver on October 3rd, 1930.

A. E. Chesters, Ltd.—Mortgage dated October 17th, 1930, to secure £1,454 8s. and further advances, charged on 2, Atherton Street, New Brighton. Holders: Halifax Building Society.

London Switch-Plate Co., Ltd.—Capital, £2,000 in £1 shares (increased from £1,100 in September, 1930). Return dated April 4th (filed July 7th), 1930. 1,100 shares taken up. £1,100 paid. Mortgages and charges, nil.

John Kirkaldy, Ltd.—Satisfaction in full (1) on November 10th, 1927, of mortgage dated March 27th, 1903, and registered July 10th, 1908, securing £2,800, and (2) on May 9th, 1929, of charge dated March 27th, 1908, and registered July 10th, 1908, securing £1,000. (Notice filed October 27th, 1930.)

Hope's Heating and Lighting, Ltd.—Capital, £50,000 in £1 shares. Return dated June 20th, 1930. 27,000 shares taken up. £12,737 paid. £14,263 considered as paid. Mortgages and charges, nil.

Ricardo & Co., Engineers (1927), Ltd.—Capital, £21,000 in 20,000 cumulative participating preference shares of £1 each and 20,000 founders' shares of 1s. each. Return dated September 29th, 1930. All shares taken up. £2 paid. £20,998 considered as paid. Mortgages and charges, £6,000.

Battroids, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1929 (filed October 4th, 1930). 245 shares taken up. £75 paid. £170 considered as paid. Mortgages and charges, nil.

Burovox, Ltd.—Agreement of charge on the company's unpaid and uncalled capital, dated October 28th, 1930, to secure £1,582 and all moneys due or to become due not exceeding £2,500, payable by the guarantors to Lloyd's Bank, Ltd. Holders: E. S. Haslam, Beardsall Priory, near Derby, and others.

Lincolnshire Power Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 13th, 1930. All shares taken up. £2,505 5s. paid (being £1 per share on 7 shares and 5s. per share on 9,993 shares). Mortgages and charges, nil.

Domestic Electrification, Ltd.—Capital, £30,000 in £1 shares. Return dated June 26th, 1930. 25,000 shares taken up. £25,000 paid. Mortgages and charges, nil.

Colvern, Ltd.—Capital, £20,000 in £1 shares. Return dated June 16th (filed August 18th), 1930. 10,000 shares taken up. £2,500 paid. £7,500 considered as paid. Mortgages and charges, nil.

Radio Installations, Ltd.—Capital, £100 in £1 shares. Return dated May 20th, 1930. All shares taken up. £100 paid. Mortgages and charges, nil.

Intensalite Sign and Fixtures Co., Ltd.—Capital, £1,000 in £1 shares. Return dated May 12th, 1930. All shares taken up. £1,000 paid. Mortgages and charges, nil.

A. P. Lundberg & Sons, Ltd.—Capital, £30,000 in £1 shares. Return dated May 14th, 1930. All shares taken up £30,000 paid. Mortgages and charges, £10,000.

Hall's Longitudinal Lighting Co., Ltd.—Capital, £5,000 in 1,250 ordinary shares of £1 and 75,000 deferred shares of 1s. each. Return dated June 5th, 1930. 20,200 deferred shares taken up. £1,010 paid. Mortgages and charges, £500.

E. J. Wilcock, Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated October 3rd, 1930. 351 preference and 500 ordinary shares taken up. £851 paid. Mortgages and charges, nil.

City Notes.

Atlas Electric & General Trust, Ltd.

Presiding at the annual meeting on November 6th, Mr. W. Sandford Poole (chairman) in the course of his speech said that the year under review had been a transition period. The second half of the purchase price for their Argentine undertakings was in their hands for less than three-fourths of the financial year. The revenue account, being framed on the basis of revenue actually received, did not represent the income of a normal year, as many investments made had not been held long enough to produce a full year's, or in some cases, even a half-year's return. At March 31st last their holdings were distributed as follows: Great Britain and the Dominions, 63 per cent.; North, South and Central America, 21 per cent.; Europe, 10 per cent.; elsewhere, 6 per cent.

Wireless Telegraph Company of South Africa, Ltd.

This company's title has been changed to "Overseas Communications of South Africa, Ltd." The change is the result of the amalgamation of the cable and beam wireless interests in this country, and it has been arranged, with the sanction of the South African Government, that cable and wireless working in South Africa shall be established on a co-operative basis. The company will operate the cable in addition to the wireless circuit, and its licence has been extended to December 31st, 1944. The annual report for the year ended June 30th, just issued, shows a net profit of £73,276, nearly 30 per cent. on the issued capital. A final dividend of 7½ per cent., with a bonus of 2½ per cent., is announced. An interim dividend of 7½ per cent. was paid in June.

Calcutta Tramways Co., Ltd.

The *Financial Times* states that a circular has been issued to ordinary shareholders, stating that, in view of the effect on the company's traffic of the prevailing adverse trade and generally abnormal conditions in Calcutta, the directors have decided to postpone consideration of a payment of a dividend on the ordinary shares until the result of the year's working to December 31st next has been ascertained.

Rushden & District Electric Supply Co., Ltd.

The shareholders of the company have been offered, *pro rata* to their holdings, 15,000 £1 ordinary shares at the price of 25s. each. The company is also giving the share- and debenture-holders an opportunity of taking up £10,000 of 5 per cent. debenture stock at 95 per cent. The proceeds are required to finance the company's extensions, especially those to Oundle and neighbouring villages.

Tata Power Co.

The net profits for the year ended June 30th last were Rs. 9,39,560, as against Rs. 2,71,521 in the preceding year. After writing off loss on investments, &c., it is proposed to pay a preference dividend of 7½ per cent. for one year to June 30th, 1928, and to carry forward Rs. 81,714. The sales of electricity increased from 110,000,000 to 139,000,000 kWh.

John I. Thornycroft & Co., Ltd.

The trading profit for the year ended July 31st last was £112,371, as compared with £145,393 in the preceding year, to which is added £61,882 brought forward, making £174,253 available. After deducting debenture interest, &c., a dividend is paid on the ordinary shares of 13 per cent. (17½ per cent.), and £59,258 is carried forward.

British Electric Traction Co., Ltd.

Interim dividends are announced of 3 per cent. on the 6 per cent. cumulative participating preference stock and 4 per cent. on the 8 per cent. non-cumulative preferred ordinary stock.

Allen-Liversidge, Ltd.

A dividend has been declared on the preference shares at the rate of 6½ per cent. per annum (less tax) for the six months ended October 31st last.

Johnson & Phillips, Ltd.

An interim dividend is announced on the ordinary shares of 5 per cent., less tax (same).

Siemens Bros. & Co., Ltd.

The interim dividend on the ordinary shares is again 2½ per cent.

French Companies.

The *Société Industrielle des Téléphones* records a net profit of 15,588,000 fr. for 1929-30, as against 10,200,000 fr. in the previous year, and the dividend is raised from 27 fr. to 40 fr. per share.

The *Société de Constructions Electriques de Nancy* reports an increase in the net profits from 933,000 fr. in 1928-29 to 1,142,000 fr. last year, and the dividend is raised from 11 to 13 per cent.

The *Société Electro-Câble* announces that the net profits increased from 11,670,000 fr. in 1928-29 to 13,512,000 fr. last year; the dividend remains at 10 per cent. on the ordinary share capital of 82,500,000 fr.

Stocks and Shares.

Tuesday Evening.

The principal influence dominating Stock Exchange markets is the expectation that the Government and the Treasury will shortly produce a scheme for dealing with conversion of the 5 per cent. War Loan or of reducing the interest on the issue on the same lines as those which Mr. Goschen adopted in his famous plan, when the interest on Consols was lowered, by stages, from 3 per cent. to the 2½ per cent. which is paid to-day. There has been a little less elasticity in the money market than Lombard Street has been accustomed to of late, and a fairly general setback occurred in the prices of gilt-edged securities, some prices losing as much as a point in a day. The root fact remains, however, that trade is poor throughout the country, that the indications for the coming winter are not particularly promising, and that in such circumstances the value of money is more likely to decline than it is to improve, with the result, of course, that gilt-edged securities and all safety-first stocks and shares must remain in demand at constantly increasing values.

"Trade Money."

The argument is daily heard that a good proportion of the vast amount of money which is being placed into gilt-edged securities is no more than what is termed trade cash; that is to say, money which seeks temporary employment in Stock Exchange securities for lack of profitable employment elsewhere. As soon as there is an improvement in trade, these moneys will be required for industrial purposes, and the securities in which the capital is at present invested may be expected to react in price. As to how long the present state of affairs is likely to continue, only the rash prophet will attempt to forecast. Speculation amuses itself with guesses as to when the next General Election will take place, and in the Stock Exchange, quotations have already been given for "Majorities," when the present Government goes out.

Gilt-edged Stocks.

So far, the foregoing considerations respecting money and trade have had little effect upon the safety-first securities connected with electrical companies. The recently-offered London Electric Railway 5 per cent. debenture stocks are retaining their strength at 4¼ premium. G.E.C. new debenture at 3¾ premium is ¼ down on the week. Yorkshire Electric 5 per cent. debenture at 104 shows a gain of ¼. Newcastle-on-Tyne debenture keeps firm at 103½. London Electric 4 per cent. debenture stock has risen to 83½, and the four 5 per cent. preference stocks of the City & South London Company are all a point to the good at 89½. Metropolitan District assented first preference at 66½ is 2 higher.

"Underground" Issues.

There is on offer £15,000 London Electric 5 per cent. redeemable debenture, 1985-1995, of the July issue (carrying a coupon of £1 6s. 8d., payable on New Year's Day next), at 104¼, being a little lower than the price mentioned here last week. The stock is free of stamp and fee, and pays £4 16s. per cent. on the money. Of the second issue, that which came out last month, £10,000 stock can be obtained at 104 free of stamp, the difference being that the coupon due on January 1st is for 10s. only. There is also £5,000 Central London 5 per cent. debenture, available at 104, also free of stamp, with a 10s. per cent. coupon due on January 1st; and £5,000 Underground Electric Railways 5 per cent. first mortgage debenture, 1942-1963, at 101¼, ex the dividend due on Saturday in this week. The yield on the money comes to £4 18s. 6d. per cent., and the stock can be bought free of stamp duty. Apart from these four offerings, there is hardly anything to be obtained in Tube Railways prior-charge securities.

Metropolitans are a little lower at 71, but Districts put on a point at 76½. Underground Electric ordinary are unchanged at 24s. There has been something of an inquiry during the past few business days for Home Railway stocks, but the traffics shown by the steam lines are still the reverse from encouraging. London & Suburban Traction preference have gone back to half-a-guinea.

Electricity Supply Shares.

Metropolitan Electric ordinary rose to 41s. 3d., London Electrics to 25s., and County of London to 48s. Amongst the provincial issues, Bournemouth and Poole strengthened to £3, Scottish Power rose to 30s., and the new shares to 29s. 6d. Midland Electric Power are 6d. harder at 31s. Midland Counties new shares rose to 3s. 3d. premium. Northamptons held their rise at 44s. 9d., and Egham and Staines kept very steady at 30s. Edmundsons' preference are a shade harder at 25s. 6d. The debenture remains a good market at 99½. There is £10,000 stock on offer at a point higher than this, giving a return on the money of £4 19s. 6d. The first payment of interest is one of £1 16s. 4d. per cent., due on January 1st next. The amount required for the annual interest on the stock is £69,000; last year's profits showed £216,000 available

Newcastle and District 4½ per cent. first debenture has risen 5, to 85½, and the 6 per cent. second debenture, at 150½, is 2 points better.

Amongst the Indian shares, Calcutta Light and Power strengthened to 47s. Of the South Africans, Victoria Falls ordinary at 3 are 1/16 higher on the week.

Cables and Wireless.

Cables and Wireless stocks gave way, though to a small extent, upon the news that the American Telephone and Telegraph Company intends to lay a cable between the United States and this country, in which cable the Post Office is reported to be intent upon acquiring a half-interest. Confirmation of this latter point is still awaited, but that the American Telegraph and Telephone Company had in mind the laying of a new cable is nothing fresh. Why the British Post Office should deliberately favour the American project, in direct opposition to the Cables and Wireless merger that is a combination of British companies, has yet to be explained. The Labour Party has been hostile, of course, to the amalgamation of the British Cable Companies with the Marconi Company since the idea was first mooted. The contract for the new submarine cable is expected to be shared between German and English firms.

The price movements are, as already mentioned, of little account, the 5½ per cent. preference and the "B" ordinary stock both giving way to the extent of a point each. American Telephone and Telegraph has fallen 7½ points to 192½, International Telephones at 27½ are 2½ down. Globe Telegraph ordinary have recovered to 14½.

Anglo-American Telegraph deferred stock at 25½ has risen 5s. The persistent inquiry for gilt-edged stocks has caused a rise of a point apiece in the 4 per cent. debenture stocks of the Eastern Telegraph and the Eastern Extension, the prices both standing at 79½. Western Telegraph 4 per cent. debenture is up 2 points at 80½. Automatic Telephones have improved to 35s., and International Automatics to 33s. 9d. The Cables and Wireless board has announced that the number of directors is to be reduced from the present 22 to 14. The saving in fees is expected to be £35,000 per annum. There are a good many other companies which might follow this example.

Dollar Stocks.

American utility shares have been weak, and falls in New York have been reflected by depression in Paris, in which latter city serious financial trouble has recently developed. Brussels, too, is hard hit by the drop in oil shares, and this has an indirect influence upon various industrials in which the Dutch markets are interested. Pennsylvania Water has shed 6 points to 62½. Shawinigan Water gave way to 53. Consolidated Gas and Electric Light of Baltimore shares at 87½ are 7 down. The Brazilian group keeps tolerably firm, though Rio de Janeiro Tramways 50-year bonds at 84½ are slightly lower on the week. On the other hand, San Paulo 5 per cents at 84½ are better. Brazilian Tractions show no change at 26½. Hydro-Elcetrics fell to 26¾, the "B" preference being lower at 7¾. Barcelona Tractions weakened to 25. British Columbia Power "A" shares remain at 37, and the "B" at 12½. Dealings are taking place in Brazilian Traction rights, on the basis of ⅜ per hundredth. These rights represent the scrip dividend, paid last quarter on the shares, in lieu of a cash distribution.

Amongst other foreign shares, Philips' Incandescent Lamps have fallen to 7s. 6d. to 33s. 9d., owing to the depression in Brussels. Atlas Light and Power, after being up to 24s. 6d., reacted to 23s.

Manufacturing and Equipment.

Telegraph Constructions have recovered £1 to 18½, after their abrupt fall of a week ago. Crompton Parkinson ordinary are better at 20s. 9d. G.E.C. preference at 25s. 9d. have risen 6d. The ordinary shares touched 47s. 6d., to recede later, however, to 45s. 9d. The 7½ "B" preference gained a few pence at 27s. 3d. British Insulated ordinary at 70s. are 1/16 up. The resolution for modifying the trust deed, in order that the company may redeem its debenture stock, was unanimously adopted at the meeting held last week. Johnson & Phillips announce an interim dividend of 5 per cent., the same as that of a year ago. The price of the shares is unchanged at 37s. 6d., at which the return on the money, assuming maintenance of the previously paid 10 per cent. dividend for the year, comes to £5 6s. 8d. per cent. Siemens at 22s. show an advance of 9d. Ferranti preference came into request at 20s. 9d., and there has been a little inquiry for Callender's 6½ per cent. preference, the shares being buyers at 25s. The 7½ per cent. "B" preference are quoted at 27s. 9d. Telephone Rentals are a shade harder at 3s. India-Rubber preference fell back to 12s. 6d. Associated Electrical Industries at a guinea are 2s. 6d. lower, but the company's 4 per cent. debenture stock has risen 3 points to 77½ in the demand for all such securities.

In the rubber market, the changes are few and far between. Business is extremely meagre, and the price of the raw material keeps no better than a shade above 4d. per lb. Amongst iron and steel shares, Babcock & Wilcox at 52s. 6d. are 6d. lower. Vickers touched 8s. before receding to 7s. 6d. The general tendency of the market is a little easier.

Share List of Electrical Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price Nov. 11 1930.	Rise or fall	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	15	15	3	+⅛	5 0 0
Brompton Ordinary	1	8½	8½	26/6	—	5 5 8
Charing Cross Ordinary	1	8½	8½	28/-	—	5 0 0
do. do. 4½% Pref.	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8½	8½	27/-	—	5 3 9
City of London	1	10	10	34/6	+9d.	4 1 2
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	37/-	—	4 6 6
County of London	1	7	10	48/-	+1/-	4 3 4
do. do. 6% Pref.	1	6	6	24/6	—	4 19 6
Edmundson's 7% Pref.	1	7	7	25/6	+6d.	5 9 10
Elec. Supply Corporation	1	11	11	47/-	—	4 13 7
Kensington Ordinary	1	8	8	27/6	—	5 1 10
Lancs. Light and Power	1	7½	7	25/-	+6d.	5 12 0
London Electric	1	8½	9	31/6	+1/-	4 9 0
Metropolitan	1	9	10	2½	+1/16	4 14 1
do. 4½% Pref.	1	4½	4½	17/6	+6d.	5 2 10
Midland Counties	1	6½	7	28/6	+6d.	4 18 3
Mid. Elec. Power	1	15	8	31/3	+6d.	5 2 5
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—	5 1 0
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.	1	6	6	23/6	—	5 2 2
St. James' and Pall Mall	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	8	30/-	+6d.	5 6 8
South London	1	8½	8½	27/-	—	5 3 8
Urban Ordinary	1	7	7	29/6	—	4 15 0
Westminster Ordinary	1	8½	8½	28/-	—	6 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/-	—	6 0 0
Yorkshire Elec.	1	8	8	32/-	—	5 0 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	79	—	5 1 3
Metropolitan	,	3½	4	71	−½	5 12 8
do. District	,,	4	5	76½	+1	6 10 9
Underground Electric	£1	7	8	24/-	—	6 10 8
do. do. Income	Bonds	6	6	104	—	5 15 5
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.		1½	1½	25½	—	5 17 8
Automatic Telephone	1	10	12½	35/-	+1/16	7 8 4
Cables & Wireless 5½ Pref.	Stock	—	5½	73½	−1	7 9 8
do. A 7½ Ord.		—	—	25½	—	... ...
do. B Ord.	,,	—	—	13	−1	... ...
Globe Tel. and T. Ord.	10	10	10	14½	+½	6 18 0
do. do. Pref.	10	6	6	10½	—	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	31/3	—	8 11 6
Oriental Telephone Ord.	1	12	12	25	—	*5 1 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	17	—	14 13 4
do. do. 2nd Pref.	5	6	6	13	—	17 3 0
do. do. 5% Deb.	Stock	5	5	52½	—	9 10 6
British Electric Traction Def. Ord.	,,	5	5	1325	—	... ...
do. do. Pref. Ord.	,,	8	8	129½	—	6 6 8
Brazil Traction	100	7	8	26½	—	... ...
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	93½	—	5 8 1
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/6	−6d.	... ...
London United Tram Deb.	Stock	4	4	52½	—	7 12 4
Mexico Trams, 5% Bonds	—	5	5	59	+2	8 9 6
Mexican Light Common	100	Nil	Nil	52½	−5	... ...
do. 7% Pref.	100	7	7	74½	−1	9 8 0
do. 1st Bonds	—	5	5	78	—	6 6 7
Victoria Falls Ord.	£1	15	15	3	+1/16	5 0 0
Yorkshire (West Riding		Nil	Nil	5/-	—	... ...
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	£1	6	6	21/-	−2/6	5 14 3
Babcock & Wilcox	1	13	15	52/6	−6d.	*5 14 3
British Aluminium Ord.	1	10	10	35/-	—	5 14 3
British Insulated Ord.	1	15	15	3½	+1/16	4 5 9
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	8½	—	4 12 4
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/9	+9d.	7 4 7
do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st. Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	5½	6	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4½	—	5 17 9
English Electric	1	Nil	Nil	11/3	—	... ...
do. do. Pref.	1	8	Nil	10/-	—	... ...
Ferranti Pref.	1	7	7	20/9	—	6 15 0
Gen. Elec. Pref.	1	6½	6½	25/9	+6d.	5 1 0
do. Ord.	1	10	14	45/9	−6d.	6 2 4
Henley	1	26	30	6	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	6/8	−9d.	... ...
Johnson & Phillips	1	10	10	1½	—	5 6 8
Siemens Ord.	1	7½	7½	22/-	+9d.	6 16 4
Telegraph Construction	£2	10	10	18½	+1	*6 12 4

* Dividends paid free of Income Tax.

Our Overseas Electrical Trade.

Some Details of the Distribution of our Exports in 1929.

VOLUME III (Exports) of the annual statement of the overseas trade of the United Kingdom has now been published (H.M. Stationery Office, price 17s. 6d. net). It gives in much greater detail than the monthly accounts the statistics of shipments of the various classes of electrical apparatus and machinery and of their destinations. From this volume has been compiled the following table showing some of the principal items of apparatus and machinery exported, together with the outstanding countries of destination in 1929; the figures for 1928 have been inserted for purposes of comparison and notes of increases or decreases added. The goods and apparatus group (including cables) is summarised in a table giving the total values shipped to the different customer countries, but insufficient details are available to enable this to be done in the case of machinery.

New headings have been raised in the record of lamp exports, from which it appears that all the glow lamps shipped except about £26,000 worth were of 20 volts and over; gasfilled lamps were £337,204 in value and others were £298,887 in value, about 90 per cent. going to British countries. Satisfactory increases are shown on previous years in this trade.

	1928.	1929.	Inc. or dec.
	Thousands of £.		
Electric wires and cables, insulated.			
Rubber insulated (not telegraph or telephone)—			
Total	1,400	1,630	+ 230
To Spain	5	11	+ 6
,, Argentina	79	88	+ 9
,, South Africa	119	145	+ 26
,, India	297	305	+ 8
,, Australia	417	467	+ 50
,, New Zealand	116	113	− 3
Insulation other than rubber (not telegraph or telephone)—			
Total	1,465	1,762	+ 297
To China	88	60	− 28
,, Brazil	31	69	+ 38
,, Argentina	92	137	+ 45
,, South Africa	127	170	+ 43
,, India	217	309	+ 92
,, Straits Settlements ...	55	74	+ 19
,, Hong Kong	33	18	− 15
,, Australia	388	518	+ 130
Telegraph and telephone wires and cables—			
Total	855	1,118	+ 263
To Spain	9	187	+ 178
,, Chile	45	71	+ 26
,, Brazil	8	100	+ 92
,, Argentina	100	80	− 20
,, Australia	177	251	+ 74
,, New Zealand	112	77	− 35
Submarine telegraph and telephone cables—			
Total	630	424	− 206
To Spain	28	89	+ 61
,, Italy	—	92	+ 92
,, United States	390	86	− 304
Telegraph and telephone instruments and apparatus.			
Wireless (except valves)—			
Total	950	950	—
To Holland	109	129	+ 20
,, Italy	37	49	+ 12
,, Japan	38	63	+ 25
,, Irish Free State	39	51	+ 12
,, Australia	95	91	− 4
Other instruments and apparatus—			
Total	1,674	1,892	+ 218
To Spain	39	85	+ 46
,, Egypt	16	103	+ 87
,, Chile	67	99	+ 32
,, Argentina	426	395	− 31
,, Straits Settlements ...	15	89	+ 74
,, Australia	401	367	− 34
Wireless valves—			
Total	180	227	+ 47
To Holland	1	17	+ 16
,, Japan	14	15	+ 1
,, Irish Free State	12	12	—
,, South Africa	14	14	—
,, Australia	56	48	− 8
Accumulators (including parts).			
Portable—			
Total	481	443	− 38
To Denmark	54	44	− 10
,, India	106	92	− 14
,, Australia	105	76	− 29
,, Canada	19	29	+ 10
Stationary—			
Total	454	417	− 37
To Holland	18	26	+ 8
,, India	100	119	+ 19
,, Australia	130	99	− 31
,, Canada	44	19	− 25
Lighting accessories and fittings (including switches)—			
Total	641	724	+ 83
To Argentina	33	44	+ 11
,, Irish Free State	30	47	+ 17
,, South Africa	65	77	+ 12
,, India	124	123	− 1
,, Straits Settlements ...	25	26	+ 1
,, Australia	117	135	+ 18
,, New Zealand	72	57	− 15
Commercial instruments (including ammeters, voltmeters, &c.)—			
Total	180	160	− 20
To South Africa	11	17	+ 6
,, India	43	36	− 7
,, Australia	35	29	− 6
House service meters—			
Total	140	152	+ 12
To South Africa	11	12	+ 1
,, India	28	35	+ 7
,, Australia	13	12	− 1
,, New Zealand	22	31	+ 9
All electrical goods and apparatus—			
Total	11,629	13,159	+ 1,530
To Foreign countries	4,771	5,551	+ 780
,, Sweden	91	122	+ 31
,, Denmark	155	132	− 23
,, Holland	242	337	+ 95
,, Belgium	122	121	− 1
,, France	250	236	− 14
,, Portuguese East Africa ...	81	109	+ 28
,, Spain	157	486	+ 329
,, Italy	356	500	+ 144
,, Egypt	197	311	+ 114
,, China	220	209	− 11
,, Japan	161	227	+ 66
,, United States	481	281	− 200
,, Chile	206	255	+ 49
,, Brazil	177	315	+ 138
,, Argentina	915	932	+ 17
To British countries	6,858	7,608	+ 750
,, Irish Free State	310	397	+ 87
,, South Africa	688	831	+ 143
,, India	1,500	1,609	+ 109
,, Straits Settlements ...	280	357	+ 77
,, Malay States	117	126	+ 9
,, Ceylon	160	137	− 23
,, Hong Kong	136	182	+ 46
,, Australia	2,316	2,547	+ 231
,, New Zealand	666	696	+ 30
,, Canada	204	251	+ 47
Electrical Machinery, etc.			
Generators.			
A.c.—			
Total	847	699	− 148
To Soviet Union	67	107	+ 40
,, Japan	14	50	+ 36
,, Argentina	74	33	− 41
,, South Africa	29	53	+ 24
,, India	177	102	− 75
,, Australia	123	90	− 33
,, Canada	69	57	− 12

	1928.	1929.	Inc. or dec. Thousands of £.
Generators—contd.			
D.c.—			
Total	431	416	− 15
To Japan	6	49	+ 43
,, Argentina	40	21	− 19
,, South Africa	30	21	− 9
,, India	145	148	+ 3
,, Australia	45	36	− 9
Motors.			
Traction—			
Total	475	294	− 181
To Japan	67	19	− 48
,, Argentina	42	14	− 28
,, India	139	95	− 44
,, Australia	106	112	+ 6
Other motors, a.c.—			
Total	779	727	− 52
To France	9	14	+ 5
,, China	14	13	− 1
,, Brazil	21	24	+ 3
,, Argentina	66	23	− 43
,, South Africa	54	68	+ 14
,, India	124	146	+ 22
,, Straits Settlements ...	24	25	+ 1
,, Australia	123	109	− 14
,, New Zealand	50	48	− 2
,, Canada	57	79	+ 22
Other motors, d.c.—			
Total	376	449	+ 73
To Holland	21	30	+ 9
,, France	6	21	+ 15
,, South Africa	34	31	− 3
,, India	81	74	− 7
,, Australia	56	61	+ 5
,, Canada	34	44	+ 10

	1928.	1929.	Inc. or dec. Thousands of £.
Convertors and transformers.			
Rotary—			
Total	302	235	− 67
To Japan	13	19	+ 6
,, Argentina	23	17	− 6
,, India	122	115	− 7
,, Australia	36	12	− 24
Static—			
Total	584	531	− 53
To Soviet Union	33	10	− 23
,, China	18	20	+ 2
,, Brazil	9	22	+ 13
,, South Africa	66	61	− 5
,, India	99	63	− 36
,, Straits Settlements ...	27	44	+ 17
,, Australia	82	102	+ 20
,, New Zealand	83	71	− 12
Control and switchgear—			
Total	1,706	1,775	+ 69
To Soviet Union	93	133	+ 40
,, Holland	48	65	+ 17
,, China	36	51	+ 15
,, Brazil	37	87	+ 50
,, Argentina	135	33	− 102
,, South Africa	141	171	+ 30
,, India	356	385	+ 29
,, Straits Settlements ...	149	43	− 106
,, Australia	273	294	+ 21
,, New Zealand	113	66	− 47
,, Canada	35	51	+ 16
Ignition magnetos—			
Total	47	39	− 8
Vacuum cleaners—			
Total	32	24	− 8
Electrical machinery not elsewhere specified—			
Total	1,113	1,160	+ 47
Including to foreign countries	442	477	+ 35
,, ,, British countries	671	683	+ 12

Boiler Practice.

Progress and Development of Steam Generators for Electrical Power Purposes.

AT the opening meeting on October 28th of the 1930-31 session of the London Technical Group of the Electrical Power Engineers' Association, Mr. G. A. Plummer presented a paper under the heading of the above sub-title. The paper was illustrated by a film showing the manufacture of boilers, and also by a number of lantern slides of actual boiler installations, depicting modern development. The following extracts are taken from the paper.

From 1917 onwards progress became rapid. Units grew in size to an alarming degree, far greater developments being made in boiler capacity, in fact, than with mechanical stokers, and difficulty presented itself in the method of firing these large units. In America, where a soft, friable, easily-pulverised coal was available, a happy way out of the difficulty was developed in the use of pulverised fuel, and it was found desirable to turn to this method of firing for the very large units then being made, and for which mechanical stokers of sufficient size were not available. With American coals, this method of firing by pulverised fuel at least reasonably solved the difficulty, and, as we followed America in the development of large water-tube boilers, the particular method of firing was brought over here and developed, and pulverised fuel has undoubtedly come to stay.

It would seem as though pressures were tending to become stabilised at between 240 and 450 lb. per sq. in., up to which riveted drums appear to be quite satisfactory. The higher pressures are no doubt desirable from a thermal efficiency point of view, but above 450 lb. pressure, and up to 650 lb., we find that it is advisable to use solid forged drums, which up to 650 lb. per sq. in. are considered satisfactory with riveted ends. For 650 lb. pressure and above it would appear desirable for solid forged drums throughout to be used. The capital expenditure, therefore, becomes considerable when the pressures increase above 450 lb. per sq. in., and the small saving in thermal efficiency must be carefully considered and balanced against increased capital charges, and one must consider £ s. d. efficiency rather than thermal efficiency.

Steam temperatures have increased considerably since 1917, and will no doubt continue to increase. Only recently a turbine has been manufactured in this country capable of working with a steam temperature of 1,000 deg. F. Suitable tubes to enable the superheater to be built for a final steam temperature of 1,000 deg. F. are available to-day at a price, but the metallurgist is progressing also, and we even now have news of steel alloy suitable for making tubes, which is claimed to withstand satisfactorily temperatures of up to 1,000 deg. F. without undue oxidation, and at a price that will not render it prohibitive.

Another line of development that has progressed rapidly is the use of preheated air. Temperatures up to 450 and 500 deg. F. have been used in this country with stokers, but the economic limit here again confronts us. We get increased maintenance costs of stoker parts, arches, furnace refractories, and so forth. It appears generally that the restricted economic limit is 300 deg. F. I can say with confidence, however, that certain lines of development will go forward in this respect, and temperatures even up to 700 deg. F. will be used in conjunction with stokers in the near future. A true understanding of the necessity for correct treatment and control of feed water has enabled the boiler-maker to produce boilers of a much higher rating than previously. Evaporation rates have advanced considerably, rates of 40 lb. evaporation per square foot of boiler heating surface per hour not being unknown to-day.

I know of boilers even to-day which run for continued periods of 6 to 9 months, and we shall shortly see the steam generator of the future a highly specialised and technical production of huge capacity, probably 300,000 to 500,000 lb. of steam per hour. Pressures of 450 lb. per square inch will be general, with higher pressures for special apparatus. Very high steam temperatures will be adopted, and the boilers will be arranged to run for lengthy periods; in fact the steam generator of the future will only be taken off range for annual cleaning and inspection. It will probably be fired with smokeless de-sulphurised fuel, and will consume its own grit in a special combustion chamber.

Discussion.

Mr. A. W. Nunn said that Mr. Plummer appeared to be an optimist of the first water. All looked forward to that Utopia in which it would be necessary only to call in and have a look at a boiler about once a year, but they had certainly not reached anywhere near that stage yet.

Mr. E. F. Hall expressed the view that it was easier to overcome the troubles encountered with the chain-grate stoker than those encountered with powdered-fuel installations, the difference being largely that, as the age of the chain-grate installation increased, the troubles tended to decrease, whereas that was certainly not the case with the pulverised-fuel job. From the point of view of the grit-collection problem, the

stoker could really afford to smile, because in a stoker-fired plant it was necessary to collect only 20 per cent. of the ash, whereas in a pulverised-fuel plant 80 per cent. of it had to be collected.

Mr. H. E. Partridge said it seemed to him that there was no antagonism whatever as between pulverised-fuel and stoker firing, and even hand firing; there was a case for each, and he did not think it was possible to lay down a law that either this, that, or the other should always be used. Care should be exercised as to how far boilers should be altered in order to suit a particular type of firing, because factors such as local geography, station load, and a hundred others had to be considered. It was fortunate, however, that pulverised-fuel firing had been introduced, for one of the results had been to wake up the stoker makers, and archless settings had been designed. He had always questioned the value of an arch, and he was always told that it acted as a refraction medium for distilling the on-coming coal. He had had an opportunity of trying that out in practice with some underfeed chain-grate stokers, the desire being to ascertain what efficiency could be obtained on a 30 per cent. load. To achieve this object, half the grate was cut off by supporting a short wall under the front wall of the boiler, whereby the arch was cut off entirely. There was a space of about 2½ inches left above the fuel bed, and the black body of coal passed under the portion of the arch which was not in service, and immediately the coal passed under the temporary wall distillation and ignition commenced. In that test he had attained 61 per cent. efficiency on 31.5 per cent. load, which was fairly good going. The fires were burned off entirely, and the only refractory effect was from the flames themselves back on to the on-coming coal. As the result of that experience he felt that the arch was very much overrated. In support of his view that Mr. Plummer's remarks as to futurne developments in boiler practice were not unduly optimistic, he recalled that last year he had visited a very large station in the U.S.A. in which boilers of 260,000 lb. per hour capacity were blown down once only every six months.

Mr. Plummer, replying to the discussion, said that even if the manufacturers did not introduce, within the next two or three years, developments such as he had presaged, they would be forced to do so soon afterwards by the requirements of the grid service. Referring to pulverised-fuel firing, he said that if one used a method of firing which resulted in a slag plastered over a portion of the useful heating surface, the boiler would not run continuously for anything like twelve months

Electricity in Steel Mills.

Some particulars of the electrical equipment recently ordered for the conversion of a steam-driven steel rolling mill in Sheffield.

IN an endeavour to reduce the cost of the power expended in rolling alloy and high-carbon steel ingots, 23 cwt. in weight, down to billets and small sections, Brown Bayleys Steel Works, Ltd., have decided, after examining different schemes in detail and inspecting various plant in this country and on the European continent, to drive electrically the existing 27-inch reversing mill at their Sheffield works.

An order has been placed with the English Electric Co., Ltd., for the whole of the electrical plant required for the conversion. Energy is to be purchased from the Sheffield Corporation Electricity Supply Department, and when the change-over takes place the mill will be directly driven by a single direct-current motor of an initial maximum output of 6,000 b.h.p.; that capacity may, however, be increased at a later date to 12,000 b.h.p. by the addition of further d.c. generating plant.

The motor will be of the forced-ventilated type and will be supplied with clean air by means of a fan and filter. The complete motor will weigh approximately 120 tons, 50 tons of which represents the weight of the rotating portion, and the shaft end will be 24 in. in diameter. A flexible coupling of the Wellman-Bibby type is to be interposed between the motor and the pinions of the mill. In order that it may be quickly and economically varied in speed to suit the rolling operations, the mill motor will require to be supplied with variable-voltage direct current, whereas the Corporation's supply at 11,000 volts will be alternating current. The equipment will therefore include a converting set consisting of an 11,000-volt, 2,000-h.p. motor driving a large direct-current generator, interposed between the supply mains and the mill motor. As the load on the mill motor will be exceedingly variable, the converting set will be provided with a cast-steel high-speed flywheel weighing 21 tons and having a rim speed of approximately 240 miles per hour, the object of the flywheel being to prevent the imposition of excessive peak loads on the Corporation's mains.

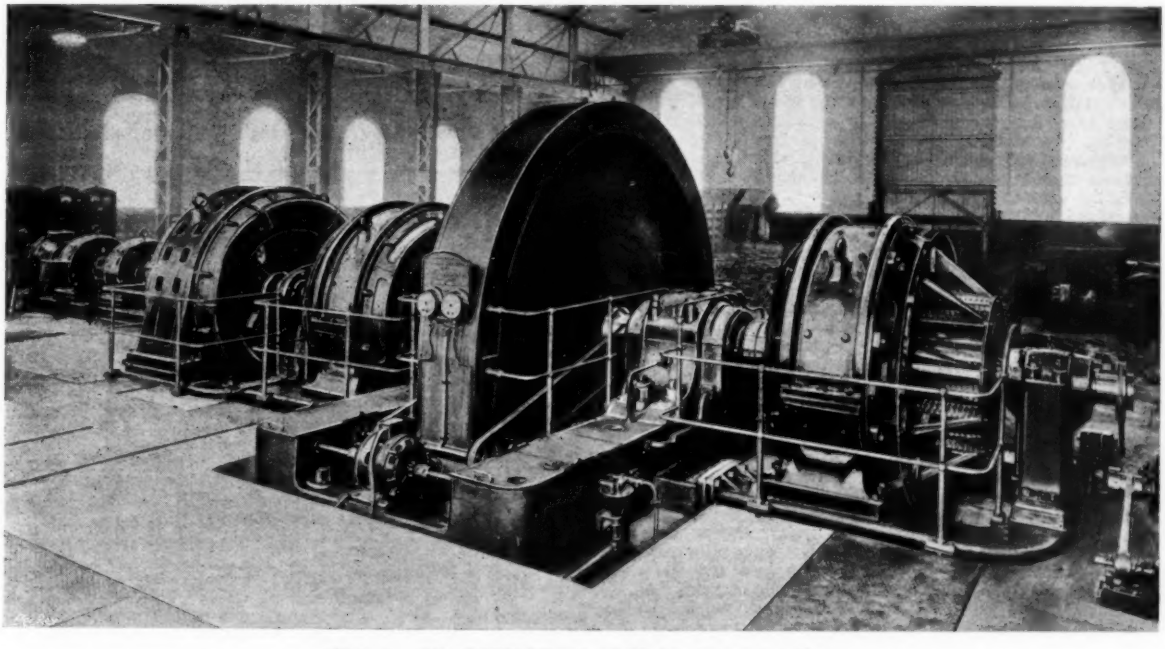


Fig. 1.—Steel Mill Flywheel Motor-generator Set.

Speed variation of the mill motor will be effected by control of the field systems of the motor and generator of the convertor set, separate exciters being installed for the field supply; hence the main circuits, which carry very heavy currents, will always remain closed, and the control gear, which will have to deal with small currents only, can be made very simple and convenient for direct handling by the mill driver. The whole of the control, both with regard to direction of rotation and

motor speed, will be carried out by a single lever which the driver will operate. The speed of the mill will be alterable

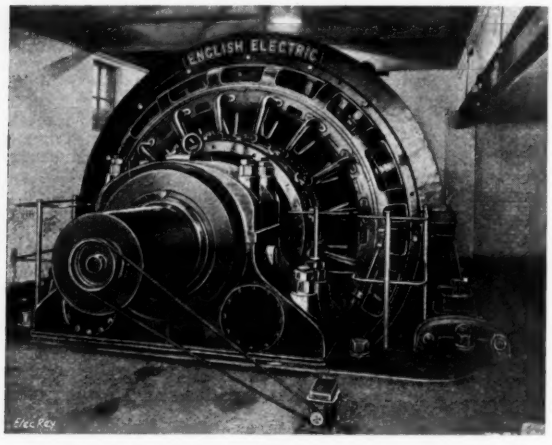


Fig. 2.—A Single-armature Rail Mill Motor.

from 70 r.p.m. in one direction to 70 r.p.m. in the opposite direction almost as fast as the driver will be able to move the lever. With the addition of a further generator to the converting set at a later date the maximum speed of the mill motor will be raised to 110 r.p.m. and it will then give 12,000 h.p.

It is only in the case of the largest installations that this particular form of control is used, and the equipment in question will be the twenty-second of similar type supplied by the English Electric Co. for use in this country and abroad. Fifteen of these equipments are employed in the steel industry and the remainder in mills dealing with other metals.

Whilst the plant above referred to has not yet been installed, the accompanying illustrations are typical. Fig. 1 shows a motor-generator set used for feeding a reversing mill motor. The flywheel is placed in the centre of the set, supported on two very robust bearings arranged with special lubrication, giving very easy starting and eliminating any wear of the bearing bushes. Directly coupled to the flywheel on either side are the direct-current variable-voltage generators, which have their fields varied from zero to maximum to meet the requirements of the mill motor. The regulation of the generator fields, and also of the field of the mill motor for the higher speeds, is carried out through an exciter set seen on the extreme left of the illustration. This allows the control gear to be very simple and easily operated by the driver, while giving quick response to the movement of the driver's lever. The flywheel set is driven by the directly coupled induction motor, and the whole is mounted on a substantial sectional bedplate, rigidly bolted together and grouted in place on the foundations. Fig. 2 shows a single-armature motor coupled direct to a reversing mill used for roughing and finishing rails of up to 100 lb. It is of 8,400 h.p. peak capacity and runs in either direction up to a maximum speed of 120 r.p.m.

The Steam Cycle.

Some Considerations which are likely to Affect and Limit its Future Development.

By K. BAUMANN.

(Extracts from paper read before the NORTH-WESTERN BRANCH *of the* INSTITUTION OF MECHANICAL ENGINEERS *at Manchester.)*

WITH the object of improving the efficiency of power stations the tendency in America and some parts of Europe has been towards the use of steam pressures above 1,000 lb. per sq. in. at temperatures generally below 750 deg. F., reheating having been necessarily adopted to prevent excessive erosion of the turbine blading at the low-pressure ends of the machines. In England and France, however, the necessity for reheating has been avoided by limiting the initial pressure (to 600 lb. per sq. in. in many cases) and increasing the temperature, often to 850 deg. F.*

Such development has involved manufacturers in a considerable amount of investigational work to enable them to produce, at reasonable prices, plant which is as reliable as that produced hitherto for lower steam conditions. Further, the increase in the final boiler feed-water temperature has accentuated, particularly at high pressures, the difficulties previously experienced in handling and regulating the delivery of the feed water from the condenser to the boiler. The invariable adoption of regenerative feed-water heating raises the question whether the practice has not been exaggerated in some cases, as by the use of a great number of heaters and greatly raising the water's temperature the efficiency or cost of the boiler plant may be affected adversely.

It is essential that in the endeavour to improve efficiency the reputation for reliability should not be jeopardised. Although a plant usually produces the major portion of its output during the first 7 or 10 years of its life, it is nevertheless desirable that it should be available for use for 20 years. Further, the prime mover should be capable of being kept in continuous operation for at least 12 months without examination and without developing such defects as steam leaks, &c.

The design of steam plant to meet these requirements is necessarily based on a knowledge of the behaviour of materials at high temperatures, in particular on the "creep" of steel.

Effect of Creep.—The old methods of stress analysis are wrong in principle, because they are based on Hooke's law, *i.e.*, on the proportionality of strain and stress, which at high temperatures applies only during a short initial period of use and is profoundly modified during later stages, due to the fact that steel, when submitted to stress at high temperatures, continues to extend very slowly beyond the initial elastic extension which occurs immediately the load is applied.

Recent experiments with improved apparatus have shown that material may creep for long periods at the rate of 10^{-6} (*i.e.*, one-millionth part of its length in 100 hours) at stresses which are considerably below those that have previously been assigned to the "creep limit." The experiments have fully justified R. W. Bailey's suggestion made a few years ago that

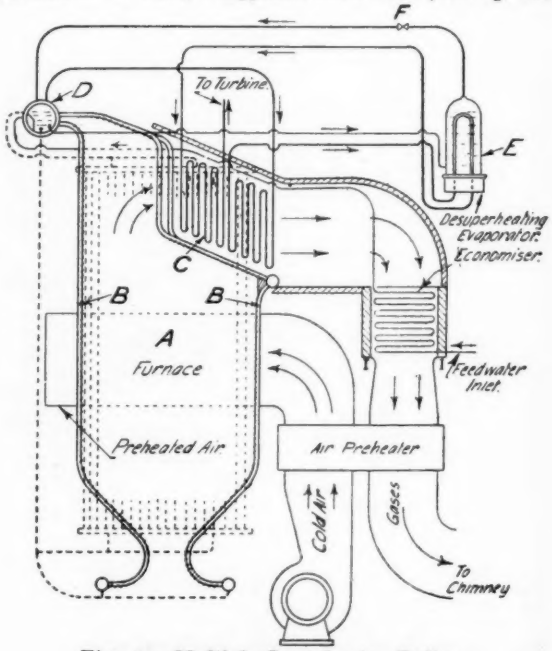


Fig. 1.—Multiple Superheater Boiler.

a creep limit does not in fact exist. It follows, therefore, that it is only a question of the actual time required to enable the stresses in machine elements to become more uniform under given normal operating conditions. As to the amount of creep which is permissible under normal operating conditions, the

* The paper contains a list of all the high-pressure, high-temperature, plant in operation and under construction (main particulars) some 28 in number.

permissible stress will depend on the time which is required for the material to creep to an extent equal to the elastic deformation under the stress applied; that time can be calculated.

For instance, if bolts are to remain tight for two years, then the elastic strain creep time must be, roughly, 20,000 hours. The rate of creep under the stress applied should therefore be of the order of about 10^{-4} per hour.

The same limits will apply to the turbine cylinder itself if the condition has to be met that the cylinder should not increase in diameter more than 0.001 in. in one inch in 10 years. For parts which depend upon shrink fits for their satisfactory operation and are not subject to adjustments, such as turbine disks shrunk on shafts, an even lower limit for creep rate must be provided for; that is, of the order of 10^{-5}.

For parts which are not riveted or bolted (jointed by welding, for instance) or have no such joints (the piping itself) higher creep rates are permissible, provided that a change in size or shape does not affect the safety or operation of the plant. Thus, for instance, creep causing an increase in the diameter of a pipe is quite permissible, whereas an increase in the length of a pipe may cause difficulties. Tests recently carried out have proved that pipes under internal pressure do in fact creep in the circumferential direction only, so that fortunately the difficulties just referred to are not likely to occur. It would seem permissible to design steam piping (apart from bolted flanges) for a creep of 10^{-7} per hour, which would mean, roughly, that the diameter of the pipe would increase 1 per cent. in 10 years. The same creep rate could also be admitted for water tubes in boilers. For superheater tubes creep rates of 10^{-6} should be permissible, or an increase in diameter of 10 per cent. in 10 years. For some of the more exposed parts of a superheater even 10^{-5} per hour may be permitted, provided these parts are easily replacable.

These creep rates are of course dependent on the further condition that the stresses shall be well below the yield point of

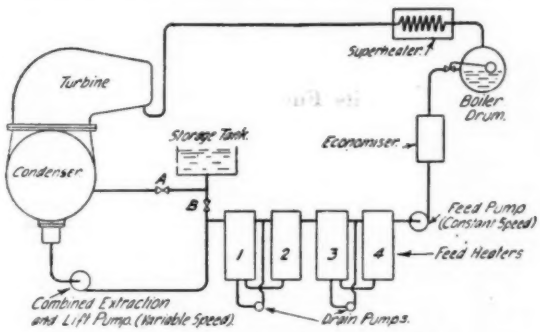


Fig. 2.—Feed-water Heating System.

the material at the particular temperature. A factor of safety of 3 relative to this yield point, or of 2 relative to the limit of proportionality, is at least required. Development is seriously handicapped by the lack of information available with regard to the creep properties of material suitable for high temperatures.

Pipes and Tubes.—Creep will be beneficial with regard to bending stresses resulting from pipe expansion. If they exceed the real creep limit (which of course they do, if they are of a magnitude worth consideration) the bending stresses will be relieved after a certain period, when the pipes are at normal operating condition, and will only re-appear when the temperature of the pipe is lowered, being a maximum when cold. Under these conditions these stresses should not exceed a value equal to half the limit of proportionality at atmospheric temperature, or less if the thrust resulting from expansion should become excessive for other reasons, or if the maximum bending moment occurs at pipe joints.

With regard to stresses in tubes transmitting heat, stress curves prove the conclusion arrived at, *i.e.*, that creep equalises the circumferential stress. Whereas it has been concluded in the past that, on account of the great increase in stresses at the inner wall, an increase in the thickness of the walls of tubes beyond a certain limit was undesirable, based on calculations of the stresses according to the elastic theory, the comparisons in the present paper show that those conclusions do not apply when the material is subject to creep, such as is bound to occur in boiler and superheater tubes. They thus draw attention to the necessity of reviewing the conditions obtaining in tubes subject to high temperatures in the light of existing knowledge of the creep of steel.

Life of Pipe Flanges.—The straight-line relationship between stress and the logarithm of creep rate holds with reasonable accuracy. Most probably a joint would have started to leak when the stress was so reduced that the pressure between the joint faces was reduced below double the steam pressure. The sharp initial drop in the bolt stresses indicates that the initial tension in the bolt does not affect the life of the joint appreciably. Creep of the flange is a much more complicated process than creep in the bolt, because the stresses in the flange are largely bending stresses and creep produces a redistribution of stress. The following three deductions merit special mention: —

(1) If the stress in the bolts due to steam thrust alone produces creep of the order of 10^{-5}, it may be possible to keep the joint tight for approximately one year, but not longer, provided the flexibility of the flange is at least equal to that of the bolts and the stresses in the flange do not produce creep.

(2) Flexibility in the flange is very desirable, provided the stresses in the flange do not cause creep; a flange of which the flexibility equals that of the bolts compensates for a reduction in creep strength of the bolt of roughly 25 per cent., or, alternatively, doubles the life of the joint.

(3) With a rigid flange the life of the joint is independent of the length of the bolt, both creep and flexibility being increased in proportion with the length, and their individual effects are compensated; a longer bolt is beneficial only if the addition of a washer, or the like, adds to the flexibility of the flange but does not add proportionately to the creep rate. In general the life of a joint is increased by additional flexibility only if the latter does not involve a proportionate increase in the creep rate of the structure.

In view of the importance of the relative flexibility of flanges and bolts, the use of a loose flange is of special interest. It is more flexible than the solid flange, its flexibility and stresses can be more readily calculated, and high-grade material can be chosen from the point of view of creep strength. For given stress conditions the creep of the flange measured in the direction of load is inversely proportional to the flange thickness, whereas the creep of the bolt is proportional to the flange thickness; the following conclusions can be drawn:—

(1) Maximum of life is obtained for a thickness of flange between 3 and 3¼ in.

(2) Maximum life of joint occurs at a point where the flexibility of the flange is about double that of the bolts.

(3) The life decreases slowly with increased thickness of the flange and finally the life parameter reaches the value of 1, *i.e.*, that for a rigid flange.

(4) The life decreases rapidly with decreased thickness of flange on account of the rapid increase of the creep of the flange.

The conclusions arrived at emphasise the urgent necessity for systematic investigations into the behaviour of flange joints at high temperatures and pressures on a greater scale than has been contemplated hitherto.

Multiple Superheater Boiler.—The investigations indicate that steam temperature is limited by the creep properties of existing materials. The use of high temperatures has been encouraged recently, as it has enabled the use of higher pressures without reheating the steam, but we are seriously handicapped by the variation in the steam temperature which occurs in most boilers using convection-type superheaters with varying load. The greater the load on the boiler, the higher the superheat, which means that at periods of highest loads the conditions become most severe, a condition which should obviously be avoided if possible.

Accordingly it becomes increasingly important to provide boiler plant in which superheat can be automatically controlled; that shown in fig. 1 meets these conditions and offers at the same time various other advantages. It retains the essential and successful parts of the existing type, but all water tubes, apart from those exposed to furnace radiation, are eliminated. Gas-cooling surface is obtained by means of tubes in which the steam is superheated twice, each process being carried out in a separate superheater; before passing from one to the other the steam is cooled in tubes partly immersed in the water in an evaporating drum, and the water so evaporated is added to the steam produced in the boiler proper and passes together with it to the first superheater. The gases pass from furnace A, which is surrounded by water walls B, to a superheater chamber C above the furnace, but protected from the furnace radiation by rows of tubes that form part of the circulatory system between the back water wall and the boiler drum D. Steam from D and the desuperheating evaporator E passes to the first superheater, which is arranged in counter current with the flue gases, and then to the cooling tubes within E. As the pressure on the water side is slightly higher than that on the steam side, the steam is cooled to a temperature higher than saturation temperature and it is then led to a second superheater, which may be in parallel current with the flue gases, in order to keep the temperature of these tubes, which are exposed to the hotter gases, as low as possible. After being superheated to the required temperature, which is automatically controlled, the steam passes to the turbine.

The final superheat is maintained constant by automatically controlling the active surface in the evaporator by lowering or raising the water level in the evaporator by means of a relatively small throttle valve F in the saturated-steam pipe from the evaporator, the valve being controlled from a thermostat in the steam pipe after the final superheater.

Economic Feed-water Temperature.—Various aspects of the subject are discussed in an attempt to determine the economic boiler feed-water temperature for a given set of conditions from the points of view of both the engine-room and boiler-house plant, and their respective costs. The result indicates

that it does not pay to strive for too much, as in the neighbourhood of the maximum efficiency the improvement with higher feed temperature is small, whereas the additional cost of its use increases continuously with the temperature; improved coal consumption is only just balanced by the additional capital expenditure.

Feed Pressure Regulation.—The major difficulties in the control of boiler feed arise from the fact that the pressure-quantity characteristic of the pumps in the system is different from that of the feed system itself. If the steam pressure at the boiler is constant, thus being independent of the load on the plant, the total pressure against which the feed water must be discharged increases with the load, whereas the total head of the pumps decreases with the load. It follows that at lower loads there is an excess pressure, which it is desirable to prevent or destroy after generation by throttling. This will avoid difficulties in the operation of the boiler feed regulating valves and the extra cost which is involved in the provision of feed heaters, feed pipes, and economisers capable of withstanding this excess pressure.

These conditions are met by the system proposed by Mr. W. Eccles, shown in fig. 2, in which the pumps between the condenser and the boiler are divided into two sections, with the feed heaters between them. The speed of the pump or pumps forming the first section is controlled from the water level in the condenser, or from a pressure obtained within the pump, which varies with the water level in the condenser. The pump forming the second section runs at full speed at all loads. A rise in the pressure in front of the boiler control valves is utilised to operate valve B discharging excess water into a storage tank and a drop in pressure to open valve A delivering water from the storage tank into the feed system. A margin of pressure would be allowed between the points which cause valves A and B, respectively, to operate to prevent hunting.

Hospital Transport.

Some of the many applications of the electric battery truck in lightening the work in public health institutions, with a note on operating costs.

(COMMUNICATED.)

IN the ELECTRICAL REVIEW for August 1st reference was made to the application of electric industrial trucks in Germany in connection with hospital and sanatorium service. Considerable progress has been and is being made in this connection in the British Isles also, where a number of electric battery trucks are in use in various well-known hospitals and sanatoriums.

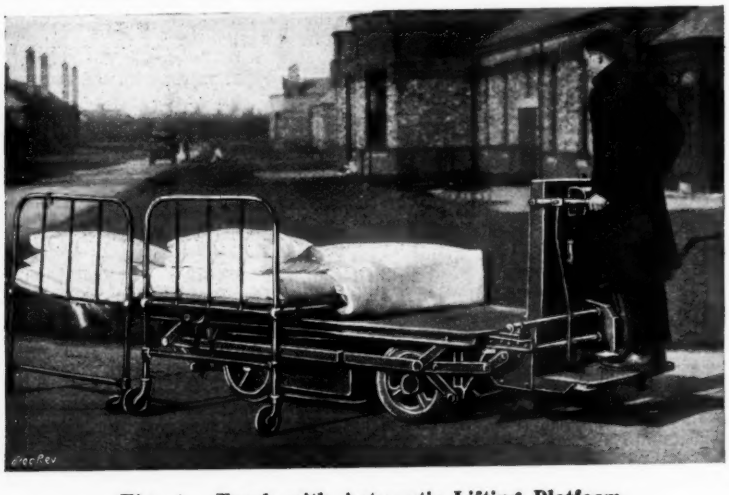


Fig. 1.—Truck with Automatic Lifting Platform.

The already tried uses are as follows:—(1) moving of bedsteads, (2) moving patients in beds, (3) inter-transport between the hospital laundry and store or wards, (4) removal of laundry bins, (5) transport of meals from main kitchen to ward kitchen, and (6) serving meals to verandah or balcony wards.

Examples of the principal applications of electric trucks are given below:—

Transporting bedsteads and moving patients.—Fig. 1 shows how this operation is carried out. The type of truck used is of 10- to 15-cwt. load capacity, having an automatic lifting platform which can be operated either by a hand lever or by power from the battery. The whole operation of picking up the bedsteads, transporting them to their destination and placing them again in position is carried out entirely by the truck driver. The fatigue caused to nurses in some of our hospitals by being called upon to carry out this sort of work must be considerable, apart from the fact that nurses are continually having to be called from one ward to another to assist in a task which in many cases could easily be accomplished, for example, by one unskilled youth driving a small electric battery truck.

Inter-transport between hospital laundry and stores or wards, and removal of laundry bins.—For this work a smaller and somewhat simpler type of truck is used, having an ordinary fixed platform. Fig. 3 shows the quantity of equipment that can be carried per load journey. This truck can easily handle two of each article per load, and in cases in which it is necessary to carry such articles considerable distances in and around the sanatorium buildings a considerable convenience and economy must be achieved, while infection risks are certainly minimised.

Patients' meals-transport from main to ward kitchens and verandah, and balcony meals.—At a large hospital or sanatorium there may be as many as five hundred patients to be catered for by one "main kitchen." The difficulties of ensuring quick transit of meals for this number, and quick disposal of the soiled crockery and cutlery after consumption, are normally very great. Fig. 2 shows the truck *en route* along one of the verandah wards. A minimum of time is lost in transit and at least double the quantity is carried per journey.

Costs of operation.—In conclusion, it would be interesting to say a few words as to what this type of electric battery truck would cost to operate.

In this connection, one or two interesting

Fig. 2.—The Service of Meals.

facts are brought to light: first, the roadways and passage ways in most large hospitals are perfectly smooth, and generally no inclines are to be found; secondly, in nearly every

Fig. 3.—Transport of Stores.

case, a standard type of almost any maker will suit the purpose.

These two facts have a distinct bearing on the operation costs. In the one instance, by virtue of continual smooth running, a very long life, both of the truck and battery, should be obtained and depreciation reduced to a minimum. In the other instance, owing to the present-day low initial cost of these small types of trucks, full advantage can be taken of standardisation. Special trucks necessarily cost more than standard types, and in considering the installation of an electric truck for any of the purposes mentioned in this article an endeavour should be made to use the standard type, with as few modifications as possible.

A fair estimate of annual operating costs for this type of truck would be as follows:—

Initial cost of truck complete, say, £160 (approx.).

	£
Depreciation of truck (10 per cent.)	12
Depreciation of battery (3 years' life—lead type*)	12
Interest at 5 per cent. (average)	3
Tire renewals	1
Spares, repairs, &c., oils, grease	5
Charging current at 1d. per kWh	10
Annual cost	£43

* If Edison 10-year life battery be used this item will be reduced to £6 approx.

To the above schedule of costs must be added driver's wages; these would be on the small side, because a lad of 16 or 17 could carry out the work quite easily.

It should be borne in mind that as the working of the electric battery truck is so simple, the controls being entirely foolproof, almost anyone on the hospital staff could operate it after only a few minutes' tuition.

One last point of interest is that consideration is being given by certain authorities of the possibility of adopting these small trucks for seating accommodation. Many large hospitals and sanatoriums have beautiful grounds, and such an application will certainly appeal to the chief medical officers for the benefit of the weaker convalescent cases.

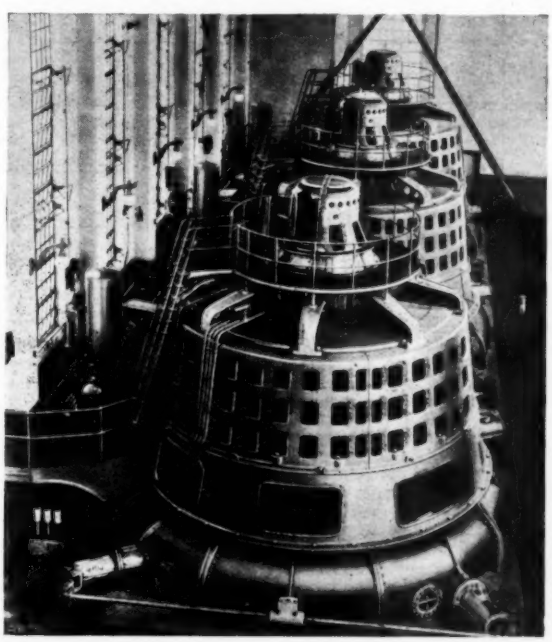
Large Vertical Alternators.

The three 13,330-kVA water-wheel alternators ordered for supply to Chile in 1928 are now in operation.

IN our issue of April 6th, 1928, p. 613, we gave some particulars of the three 13,330-kVA water-wheel alternators which had been ordered from Metropolitan-Vickers Electrical Co., Ltd., for the Maipo River power station of the Compania Hidro-Electrica Volcan, of Chile. The sets are now installed, and the accompanying illustration shows the interior of the power station. The station is situated in the Andes mountains about 40 miles south-east of Santiago, at a height of 4,250 ft. above sea level. It utilises water from the Maipo River, at a normal head of 670 ft., and its output, transmitted at 110,000 volts, feeds into a system which supplies power in bulk to undertakings in the Santiago and Valparaiso districts for lighting and industrial power services, and also for tramways and main-line railways.

The plant installed comprises three 12,000-kW generating sets, of which the water turbines were supplied by Escher Wyss & Co. The equipment was specified and ordered on behalf of the Compania Hidro-Electrica Volcan by the Whitehall Securities Corporation, Ltd. Each set stands 25 ft. 5 in. in height above floor level, with an overall diameter of 21 ft. 3 in. Each alternator, with its exciter, weighs 128 tons, of which 56 tons is the weight of the rotor. With the water-wheel runner the total weight of the rotating parts of each set is 75 tons. The water turbines are of the Pelton-wheel type, each unit having a capacity of 18,600 h.p., with a water supply of 1,870 gal. per second at the normal head. The distributing pipe, which is on the same level as the runner-wheel, is of spiral shape and is fitted on its inner periphery with four inlets, each equipped with a needle valve. The spiral serves at the same time as base for the whole turbo-generator set, the generator stator being connected to it by means of a cast-iron yoke. The four needles are actuated by an oil-pressure servo-motor arranged on the same level as the needles; another servo-motor, which operates the four deflectors, is located on a raised platform which also carries the operating gear for the governor and for the main valve, the oil pump and air vessel. The runner has twenty buckets of cast-steel bolted on to the disk by means of conical bolts. For inspection purposes, and in order to facilitate the replacement of the wearing parts of the thrust bearing, the whole rotating part of the set can be lifted by means of a jack arranged in the wheel pit underneath the shaft end. For overhauling, the runner can be lowered down the wheel pit and hauled into the power house through a special pit provided in the floor.

The generators are rated at 13,330 kVA, at a normal pressure of 12,000 volts, three-phase, 50 periods, 0.9 power factor. Their rise in temperature at normal output is guaranteed to be not more than 50 deg. C., which at their altitude is equivalent to 48.5 deg. C. at sea level. The guaranteed efficiency of the machines at full load was 95.25 per cent., but in full-load tests under the specified conditions at the makers' works the



Interior of Maiko River Power Station; 13,330-kVA Alternator Sets.

actual efficiency realised was 96.13 per cent. The stator of each machine was built up in four sections to facilitate transport, each section being shipped separately with its own part of the core and winding assembled, except for the coils

bridging the joints. Each rotor body is made up of two cast-steel wheels 11 ft. 6 in. in diameter, each weighing 12¼ tons. The poles, 24 in number, weighing just over 15 cwt. each, are secured to the rotor body by dovetails of a standard profile which have been devised by the Metropolitan-Vickers Co. to secure maximum uniform strength at all points of the dovetail in both the pole and wheel.

Tests in connection with the mechanical strengths of the forged-steel shafts involved the boring of a hole 21 ft. long through each shaft in order to permit examination of the interior by means of a device which is a combination of a telescope, periscope, and microscope.

In order finally to test the ability of each complete rotor to withstand the enormous stresses developed in such a large and heavy body at runaway speeds, it was subjected to a run at twice normal speed. This was carried out in an overspeed test house with reinforced walls 9 ft. thick specially built by the Met.-Vick. Co. for such work.

Cooling Electrical Machines.

A record of the present-day attitude towards the subject and a descriptive account of tests made to fill the gaps left by hitherto unpublished data.

By D. B. HOSEASON, M.I.E.E.

(*Extracts from a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

TWO lines of attack are open to designers for further reducing the sizes of electrical machines. First, insulation may be developed which will permit of higher temperature limits; secondly, more efficient methods of cooling may be devised to dissipate larger losses from the same active material. The proposal to raise the actual temperature limits is one which might be difficult to effect commercially, as so many buyers insist on the manufacturer working to the standardising committees' specification. Certainly, a very great deal of time and money would have to be spent in educating the public to the new temperature limits, and the easier line of attack appears to be the second.

The first essential is to form a correct mental picture of what is occurring. Most electrical engineers, when reference is made to a motor or generator, picture an electric circuit carrying current or electric flux, and a magnetic circuit carrying magnetic flux. There are, however, in all electrical machines, not two fluxes but three. Provision has to be made not only for electric flux and magnetic flux, but also for thermic flux, which exists in every machine, must have its paths provided as in the case of the other two fluxes,

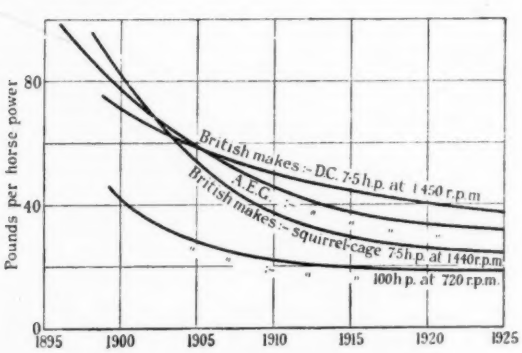


Fig. 1.—Machine Weights Since 1895.

and controls the size of the machine to an equal degree. A designer always studies the magnetic circuit of his machine to make sure that the flux path is not restricted at any point, *e.g.*, the root of the armature teeth in a direct-current motor. The cross-sections of the path of the thermic flux must also be considered in a like manner, and, furthermore, not as an afterthought, but in the actual process of building up the design. The aim of designers should be to overcome the temperature limitations in machine design, and to build apparatus limited only by the mechanical stresses in the various parts, and the first step towards this is to raise the thermic flux to a position of equal importance with the electric and magnetic fluxes, when actually carrying out the design of a machine.

In a simple air-cooled machine the temperature-rise of the hot spot is built up in three stages :—

$$\theta_t = \theta_g + \theta_a + \theta_m$$

where θ_t = hot-spot temperature-rise,
θ_g = temperature-difference between the hot spot and the dissipating surfaces over which the air flows,
θ_a = temperature-difference between dissipating surface and cooling air, and
θ_m = temperature-rise of cooling air.

It is believed that this three-term equation is the key to rational design of machines with regard to their cooling, and in the paper the subject is studied on a basis of this equation. Although some engineers now deal with temperature problems on these lines, the older practices, of which an example is the rating of field coils according to the watts dissipated per square inch of surface, are still the standard in many quarters.

The first part of the paper describes the limitations met with when approaching the problem of cooling. The standard permissible temperatures in Great Britain, Germany, and America are examined, and the restrictions due to various types of enclosure are shown. The merits and disadvantages of radial, axial, and other forms of ventilation are then discussed in relation to the different classes of machines now being manufactured, and the broader problems of cooling are reviewed. The subject is gone into in detail, the internal flow of heat in the different classes of apparatus is investigated, the results of various experiments to improve the heat flow by reducing temperature gradients are given, and comments on predetermining the temperature-rise of a machine are included.

A field for research which has been very little touched is that of heat dissipation. We require more information on such points as the influence of the roughness of the surface in axial ducts due to the stagger of the laminations, and data on the heat dissipation in the region of the turbulent air flow which exists at sudden contractions and expansions.

The type of ventilation generally favoured by manufacturers in various countries gives some indication of the lines along which designers are thinking. Turbo-alternators are in a separate class from other types of machines, and fixed or multiple-inlet ventilation is used in all parts of the world. With regard to other classes of a.c. and d.c. machines, the American practice in general is to favour radial ventilation throughout. Both axial and mixed ventilation appear to be popular for d.c. machines on the Continent, particularly in Germany, whereas elaborations of simple radial ventilation seem to be the practice for a.c. machinery. In this country the majority of manufacturers are tending to favour axial ventilation for d.c. machines, while opinion is about equally divided between radial and axial ventilation for a.c. machines.

Almost continuous progress has been made in methods of cooling since the first electrical machines were put on the market 40 years ago, and the results have been reflected in the weights of machines made by the various manufacturers. Fig. 1 shows approximately how designs have changed in weight since 1895. The curves tend to show that a position has now been reached where very little further weight reduction can be expected. It is believed, however, that the present position is only a temporary phase and that, except in the case of small machines, further reductions in size will be possible as more information becomes available.

Discussion in London.

Mr. F. Purser Fletcher remarked on the practical way in which the author had dealt with his subject. It was a matter for wonder why so many forms of motor enclosure had been retained in use. Coil insulation had been chosen for its good dielectric value, while its heat-conduction properties had been quite neglected. More attention would have to be paid to the mechanical properties of impregnating varnishes and materials than was now done if the industrial value of externally-cooled machines was to be enhanced. Fins should be staggered so as to disturb the air flow.

Mr. H. Jack pointed out that fewer types of enclosure were used on the Continent and in the U.S.A. than in England, and variety increased cost. More money might be spent on the cooling system than would be justified by results. In the case of small machines, especially of the squirrel-cage type, it might be better to make them larger than to attempt to improve their ventilation. In the case

of large machines, efficiency and power factor were the limiting factors rather than heating. He had made small machines of 3,000 and 1,500 r.p.m. with radial ducts which were quite silent, and the same methods could be applied to the larger types.

Mr. J. C. Fisher said that fan engineers had their own problems; trying to determine a fan's output was like attempting to measure the output of a pump at the bottom of the sea. Various makers' input-output figures differed greatly, and fans were too noisy. He only knew of one machine that was now made with a propeller fan, and it was a d.c. machine. Regarding the fallacy of improved cooling being obtained by forcing more air through the machine, 1,200 ft. per minute was the usual critical figure for ordinary heating work.

Prof. J. K. Catterson-Smith thought that efficiency should have been given consideration in the paper; lower figures than usual should be examined, as they should mean lower cost. Capital charges compared with the cost of the annual losses indicated that lower efficiencies might be desirable. The author invited them to pay more attention to the heat flux than it deserved, as the latter only existed because they had to use electrical and magnetic materials that were not perfect. He also cast a slur on the old watts per square inch method of designing, which was unfair, because he had not told them how to do it otherwise. He had not shown them how to depart from the old methods, and had not mentioned commutator cooling, a limiting factor in the case of large machines. Surely it was time they tried to find better materials from the thermal conductivity point of view? For instance, the use between lamination plates of varnish containing graphite, carborundum, or even fired clay ground to a fine powder, &c.; electric heater makers might help in that direction. The speaker pleaded for the use of the Calorie unit in place of "watts per minute," and for better and more robust means of temperature measurement.

Mr. J. E. Macfarlane could not agree that the totally-enclosed motor would be obsolete in a few years' time, at any rate in respect of the small d.c. type, which was preferable in chemical works, for instance.

Mr. A. D. Constable could not see how they could advance much further unless some new material were found. A motor was not an easy machine to cool, as it frequently had to be used dirty, hot, and under generally unfavourable conditions. Hydrogen was inflammable, and other disadvantages seemed to indicate that its use as a cooling medium must be slow, except for such large self-contained machines as synchronous condensers.

Mr. E. Kilburn Scott suggested that ventilation might be improved by the use of hollow shafts and conductors.

Mr. A. N. D. Kerr thought the author's D-type conductor slot arrangement looked like a Continental pattern. There they used higher temperature figures; why did they so handicap themselves, or was there something in it?

Mr. D. B. Hoseason, in reply, agreed that every designer would consider efficiency, performance, and cost, but he had kept strictly to his subject in order to limit the paper's length. In the case of small machines, it might be advantageous to make them of greater mass, so as to reduce overhead and labour charges, but if they were going to ventilate machines, they should do so systematically. Weight comparison (fig. 1) showed that foreign machines had not left English ones behind; neither were the former so well protected as ours. Poor thermal conductivity between laminations was really due to thin air films.

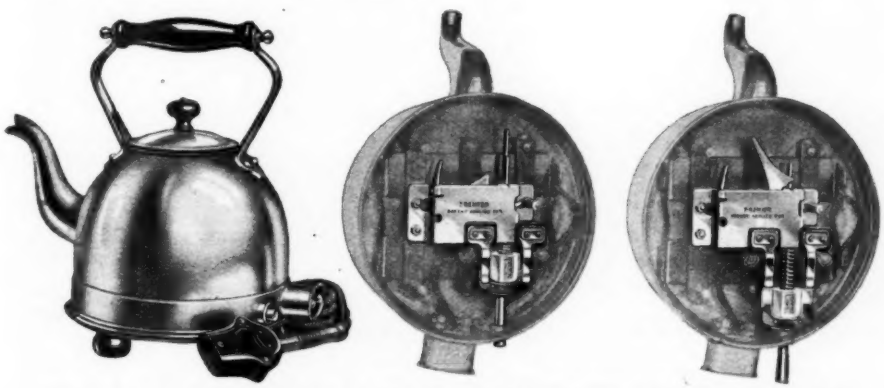
New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Safety Kettle.

PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, informs us that although its sleeve-nut protected kettles are still in considerable demand, it has produced an automatically resetting kettle which possesses several novel features. This "Quickset" kettle, fig. 1, is fitted with a bi-metal strip mounted on the heat bottom between the two heating strips; it is secured at one end only, the other end being free to bend away from the heat bottom in the direction of a pivoted catch which holds a lever at right angles to a switch rod. When the kettle is used normally, and water is boiled in it, the bi-metallic strip bends only to a limited extent, and not sufficiently to displace the catch, but if the kettle is allowed to boil dry, the strip continues to bend and the catch is moved out of engagement with the lever. The lever is then free to move away, and allow the switch rod to slide outwards and break the circuit, before any damage is done to the kettle or heating strips. The contacts are of phosphor-bronze, and are soundly insulated, whilst the bridge piece which connects them when the kettle is working normally is mounted on a solid china block through which the switch rod passes. The user cannot damage the bi-metallic strip by pressing the switch back again when hot, as the catch is then out of the way of the switch lever, and no pressure can possibly be exerted on the bi-metallic strip. The device, figs. 2 and 3, is substantial and has a very rapid action, so that no detrimental arcing occurs. The kettle is being made with this device only in the three-pint size at present (1,000 W loading).

The new kettle has been subjected to a long series of tests, on a.c. and d.c., under very rough conditions; the company has even gone to the extent of introducing, as a test, a salammoniac solution to the interior, with a view to clogging up the moving parts if possible, and it is believed that the device will stand up to any conditions that it is likely to encounter.



Figs. 1 to 3.—The "Quickset" Kettle, Switching Device "on" and "off."

A New Fault Localiser.

An important need of the mains engineer, an instrument for locating earths and short-circuits on the system with accuracy and in the minimum of time, has been met by Messrs. PRICE AND BELSHAM, LTD., 52, Queen Victoria Street, E.C.4, who have recently introduced the "Hurdy Gurdy," fig. 4, for which they claim robustness, simplicity of working, and elimination of involved calculations.

The instrument itself, which is based on the "double bridge" principle, is contained in a strong oak case, complete with leads and clips, the latter being of a unique design ensuring a low-resistance contact. The only accessories which are required for a test are a portable galvanometer and either a high-pressure dry battery or a hand generator, the latter being essential for "earths" or "shorts" of high resistance. With this kit the engineer is in a position to deal with practically every type of fault, with the exception of open-circuits, for the location of which another instrument is marketed by the same company. In operation the two main leads are connected to the faulty cable and a return, which may be either another core (sound) of the same cable, or a loose wire laid along the

ground. The galvanometer is connected to the twin flexible leads provided, and the remaining lead is taken to one terminal of the generator, the other terminal of which is earthed. Having obtained a balance on the galvanometer by turning the handle on the outside of the instrument, the reading indicated in a slot in the name plate, when multiplied by a factor, gives the distance to the fault (in yards) from the point at which the test is made. The factor is derived from a table which is kept on a form provided in the instrument. It is based upon the resistance per 1,000 yards of the size of cable under test. In practice the resistance of the return lead can usually be ignored, but should it be appreciable, the addition of six to the

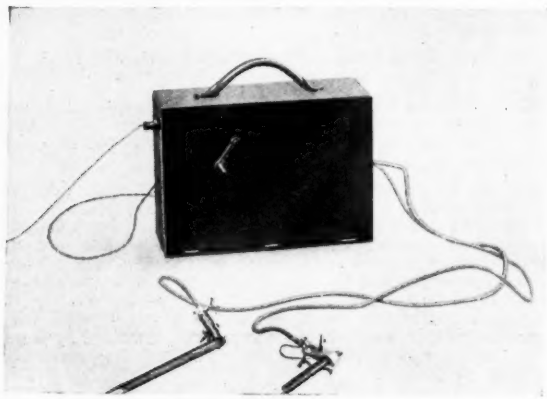


Fig. 4.—The " Hurdy Gurdy " Fault Localiser.

reading on the " Hurdy Gurdy " for every ohm resistance gives the correction. The direct range of the instrument is dependent on the cross section of the cable being tested, varying from about 3,700 yards for 0.1-sq. in. to 38,000 yards for 1.0-sq. in. cable, but by the use of multiplying resistances the range is practically unlimited. Another advantage of this instrument is that it can be used in certain cases where a bridge is impossible. With each instrument is included an instruction sheet and a diagram of connections mounted for convenience on a board, and also a pad of test sheets on which a record can be kept of every test made.

A Fluxmeter.

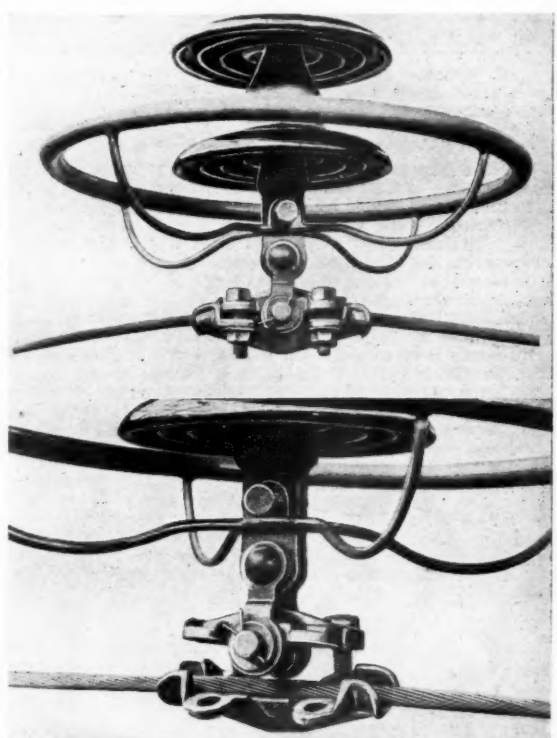
The " Grassot " fluxmeter produced by the CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1, is a suspended-coil galvanometer specially designed for the investigation of magnetic fields. Its indications are determined solely by the total quantity of electricity discharged through the suspended coil, and, owing to the long period of the moving system and the negligibly small control constant, the pointer remains deflected for a period of sufficient duration to enable readings to be taken. If a search coil connected to the terminals of the fluxmeter is moved in a magnetic field, the instrument deflection is proportional to the total change in the lines of force interlinked. Within wide limits, the reading is independent of the rate at which the magnetic lines are cut

Fig. 5.—" Grassot " Fluxmeter and Search Coil.

by the exploring coil. While the instrument is so robust that it can be used by unskilled workmen, it is of high sensitivity suitable for laboratory use. Fig. 5 shows the instrument connected to an open-wound search coil. The moving coil is suspended by a silk fibre, the upper end of which is attached to a spiral spring to avoid damage by shock. Current is led into and out of the coil by means of spirals acting in opposition, so that the torsional controlling force is a minimum. On the other hand, the electro-magnetic damping is made so great, in proportion, that the only appreciable force which controls the deflections of the coil is that due to this cause. The moving system is enclosed in a dust-tight robust metal case fitted with levelling screws and two side spirit levels. A clamping device secures the coil during transit. The scale of the instrument is approximately 150 millimetres long, and is divided into 120 equal divisions, 60 on either side of a central zero. Each division represents a definite number of maxwell-turns, this number (generally about 15,000) being marked on the scale. Thus the total number of lines cut by each turn of the search coil may be obtained by dividing the scale reading by the number of turns, and if the mean area of the search coil is known, it is easy to calculate the field strength in lines per square centimetre. Full-scale deflection corresponds to 1.8×10^6 maxwell-turns, but the range may be extended by shunting the search coil with a non-inductive resistance. It is then possible, with a single-turn search coil, to measure total fluxes up to several megalines. On the other hand, very small flux densities may be measured by using a large area multi-turn search coil. In addition to the pointer, the instrument may be fitted with a plane mirror, 5 × 4 mm., and with a lens suitable for a scale distance of one metre, so that for accurate work a light spot may be used as an index, the beam of light entering through the lens fitted in the back of the case. On open circuit the free period is approximately 50 seconds; it is aperiodic when connected to a low-resistance search coil. The resistance of the instrument is approximately 20 ohms, and the search coil may have any value below about 15 ohms; single-turn low-resistance search coils may thus be used, in which case the instrument will indicate directly the flux value. The instrument may be used in such applications as measuring the strength of a magnetic field, the pole strength and distribution of magnetism in a bar magnet, and mutual inductance, or it may be used to obtain the BH curve for a specimen, or winding data for transformers or d.c. series motors.

A New Overhead Suspension Clamp.

A new design of suspension clamp for overhead electrical conductors, figs. 6 and 7, has been produced by STEATITE AND PORCELAIN PRODUCTS, LTD., Stourport, Worcestershire, and it embodies radical departures from usual practice in this class of equipment. The outstanding practical feature of the invention is that it enables the conductor to be inserted or removed from the clamp while this is still attached to the insulator string; hitherto with trunnion clamps it has been



Figs. 6 and 7.—" Steatite and Porcelain " Suspension Clamp; Closed and Open.

necessary to remove the clamp from the insulator string before inserting the conductor. This has been made possible by extending the trunnions in opposite directions from the sides of the upper half of the clamp, and by providing elongated bolt holes on one side. These holes permit the bottom half of the clamp to hinge open relative to the top half. The point of support of the clamp lies on the centre line of the conductor to enable wave motions in a vertical plane to pass freely through the clamp, and thus avoid the usual bending up and down and consequent crystallisation of the conductor where this enters the clamp. In bolting the two clamp members together, the bolts are passed downwards through the

holes, recesses being provided in the upper surface of the clamp to receive the heads of the bolts and so prevent them from turning while the nuts are being screwed on their lower ends. Summarised, this clamp combines the following features: it provides a cable clamp having trunnions or pivots wherein the trunnions are on the upper member; it provides means whereby the distance between the attachment or supporting pin and the pivot axis is reduced materially; it provides greater ease of assembly and erection; and the conductor can be inserted into or removed from the clamp whilst the clamp remains in position on the insulator string.

New Cable-jointing Connectors.

A simple and effective means of connecting the conductors of cables in jointing has been brought about by the introduction of the new "S.E." cable thimble by Messrs. THOMPSON & Co., 1 and 3, Old Swan Lane, E.C.4. It is made from hard-drawn copper in U form, with a series of cut lips or teeth, which, pinched firmly on the conductor, make a very good mechanical joint, quite apart from the final soldering.

Figs. 8 and 9.—Applications of "S.E." Thimbles.

As a result for the demand for these straight-through connectors, a further request has been made for T connectors on the same principle. These are now ready, and it is claimed that a very considerable saving in time will be effected on each service joint by their use. A portion of one side of the sleeve is cut out and suitably lipped to receive the leg of the tee. Figs. 1 and 2 depict the construction and use of the straight-through and T thimbles, respectively. Samples and prices will be gladly sent to interested supply engineers, if they apply to Messrs. Thompson & Co., who are the sole selling agents.

A Cooker-cleaning Solution.

The introduction of what is claimed to be a very efficient means of cleaning cookers is due to the efforts of the DIRTSOLVA MANUFACTURING CO., LTD., Coalbrook Road, Kemp Town, Brighton, which has produced a compound known as "Solvac." This is safe to handle and does not contain any caustic, grit, acid or other harmful ingredient. It does its work quickly and obviates the necessity of dismantling the cooker, or even of making it hot, as it can be applied cold and wiped off with a rag within a few moments.

Device for Topping-up Batteries.

We learn of the recent invention by Mr. Stanley Rubinstein, 5, Raymond Buildings, Gray's Inn, W.C.2, of apparatus for automatically topping-up batteries. Briefly, the device consists of a distilled-water reservoir sealed except for an air vent. The bottom of this is connected by rubber pipe and branched manifolds to the cells of the battery. Float-controlled valves of celluloid, which are claimed to be immune from disturbance through vibration, allow small quantities of distilled water to reach the cells as and when required to maintain a constant level.

Parliamentary News.

(By our Special Parliamentary Reporter.)

Electrification in Norfolk.

On November 5th, VISCOUNT ELMLEY asked the Minister of Transport, whether any experiments in electrification were being carried out in Norfolk.

MR. MORRISON said that, with the assistance of a grant through the Unemployment Grants Committee, the Corporation of Norwich had undertaken to carry out an intensive scheme of rural electrification over an area of about 125 square miles. The Electricity Commissioners proposed to publish a description of the scheme, and this was in course of preparation.

Proposed Ilford "Tube."

On November 5th MR. MORRISON informed Major Nathan and Sir George Hamilton that the London and North-Eastern Railway Co. had received, and was now considering, the report of the engineers appointed to investigate the possibility of constructing a tube railway to Ilford. At this stage the company was not in a position to make any further announcement.

Legal.

A Sign Dispute.

IN the Mayor's and City of London Court, before Judge Shewell Cooper last week, United Signs, Ltd., King William Street, E.C., sued Mr. D. Heathfield, proprietor of a public house in Wardour Street, W., for £55 for two signs ordered in March last. There was no dispute as to the order, or that the signs were made up to specifications, but the defendant contended that he was not bound to take delivery in that the plaintiffs had produced a sign which could not be erected because it contravened the London Building Act.

Counsel for the plaintiffs said that the contract between the parties did not call upon the plaintiffs to obtain the necessary consents from the London County Council, or the Westminster Borough Council. The plaintiffs contended that it was the business of the defendant to get the consents, if necessary, although they were prepared to assist in this direction.

MR. LAWRENCE JOHNSON, sales manager of the plaintiffs, said that one sign which did not offend had also been refused by the defendant.

After hearing evidence on both sides the Judge said that, in his view, the defendant had ordered a sign, and plaintiffs had made it according to the specification. The fact that it offended the regulations was the defendant's risk, and he would have to pay for it. Judgment was accordingly entered for plaintiffs for £53 10s., with costs, an allowance of £1 10s. being made as the price of £10 for the smaller sign included fixtures and fixing.

On the application of defendant's counsel leave to appeal was given.

A Sign Company Fined.

At Newton Abbot, on November 4th, the Franco-British Electrical Co., Ltd., was fined two guineas and costs and ordered to pay an advocate's fee of five guineas for erecting a sign between Torquay and Newton Abbot in contravention of the Devon County Council's by-laws. A letter was received from the defendant company asking that the summons might be withdrawn as the sign had been removed before the summons was received.

The prosecuting solicitor objected to this, as he said that the company had delayed the removal of the sign in order to gain time and receive rent for it. The sign was only taken down at the last minute. The by-laws were designed to preserve the amenities of the district.

The presiding magistrate considered that the company had had ample time in which to remove the sign and imposed the penalties mentioned above.

Electric Fire Patent Action.

IN the Chancery Division last week Mr. Justice Luxmoore gave judgment in an action brought by Naamlooze Vennootschap Fabrik van Instrumenten en Electrische Apparaten "Inventum" against S. Schneider.

His LORDSHIP said the action concerned the validity of Patent No. 113623 of 1917, and the plaintiffs alleged an infringement by the defendant. The patent was an electrical apparatus for fires, and plaintiffs claimed an injunction and other relief. Defendant, in his defence, denied infringement, and pleaded that the patent was invalid for want of subject matter, novelty, &c. The question which his Lordship had to decide was whether the letters patent were valid. The plaintiffs' patent claimed that the fire had the advantage of non-oxidising wire, and was an improvement on existing heating apparatus inasmuch as the wires were capable of movement with the heat. His Lordship said that the plaintiffs claimed a monopoly of this electric heating apparatus for wires hanging loosely. He was satisfied on the evidence that the alleged invention claimed by the plaintiffs could not form a valid patent, and the patent was invalid on the ground of lack of subject matter. Also if the alleged invention had been proper subject matter for the grant of a valid patent, that invention had been anticipated by three prior patents. Further, he came to the conclusion that even if the patent was valid, the defendant had not infringed it. The action failed, and he dismissed it with costs.

Surface-water Supply of Canada.

The Dominion Water Power and Hydrometric Bureau of the Department of the Interior of Canada has recently issued volume 63 of the Water Resources Papers, which deal with the surface water supply of Canada. This number contains the results of investigations made by the Dominion hydrometric survey during the climatic years October 1st, 1926, to September 30th, 1928, in the provinces of New Brunswick, Nova Scotia, and Prince Edward Island. The report contains a short explanation of the purpose and scope of the work, and seventy-six pages of stream flow and meteorological data, with an index map showing drainage areas and the location of the gauging stations. Copies may be obtained free of charge on application to the director of the Bureau, Ottawa, Canada.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

"Where do Contractors go in the Winter-time?"

The editorial notes in the ELECTRICAL REVIEW of November 7th under the above heading may give the impression that the Association of Supervising Electrical Engineers is limited to the electrical contracting industry, and that the educational work of interest to the engineers in that part of the industry has not been adequately catered for.

With regard to the first point, while it is true the A.S.E.E. is the only association recognised for supervising engineers and foremen employed in the electrical contracting industry, it also includes amongst its membership electrical engineers engaged on public and private establishments, and commercial engineers.

The wide scope of the A.S.E.E. membership has enabled it to cover in the lecture programmes subjects of a varied nature which, to a great extent, are of interest not only to the contracting section, but also to the membership as a whole. I enclose a list of lectures given under the auspices of the A.S.E.E. during the past three years, which will be of interest in this connection.

The programme for the 1930-31 session is of an equally varied nature, including:—"Electric Lamps"; "Electric Panel Warming of Buildings"; "Progress in Power Cable Technique"; "Modern Power Station Turbo-Alternators"; "Modern Electric Traction"; "Electric Welding"; and "Ventilation by Air Movement."

The expansion of the electrical contracting industry necessitates the close attention of those holding responsible positions in the industry to a wide range of subjects, but it has been found there are particular problems applicable to the contracting industry and other sections of the industry which need, from time to time, consideration by the particular section involved. The A.S.E.E. has appreciated this, and recently decided to form sections within the Association. In furtherance of this policy, a meeting of members of the Association employed in the electrical contracting industry is to be held next month with a view to forming a contracting section.

I am afraid I cannot answer the question, "Where do Contractors go in the Winter-time?" asked in the title of your notes, but it may be of interest to note that the average attendance at the A.S.E.E. lectures duirng the 1929-30 session was well over the 100 mark, and, although our accommodation is sometimes severely taxed, members of the E.C.A. will be cordially welcomed at our educational gatherings.

A. Brammer,

General Secretary,
ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.

London, W.C., *November 10th*, 1930.

Lest We Forget!

Lest we forget! Another Armistice Day celebrated—and passed! The poor fellows gone none can recall. For their maimed and permanently injured comrades much can still be done. Engineers could remember when filling vacancies, as and when they occur, that a proportion of them might be given to disabled ex-service men. It is also necessary to remember that many men who joined up in 1914 are now over 30 years of age and could not pass a medical examination now, although they did so before joining up.

Disabled.

November 11th, 1930.

The Drumm Battery.

I shall be glad if you will allow me to say that I had no idea of making any allegation that Mr. Tweedy had a financial interest in the Drumm battery. Mr. Tweedy says that the battery is produced specially to drive trains on Irish railways without burning imported coal. Such a very limited market for the battery does not warrant any but local interest or investment, and one wonders why there should be such carefully-graded publicity in the daily Press.

Mr. Tweedy has been unwittingly a party to the propagation of an oblique statement claiming a high figure of watts per pound *per hour* without explaining that this means (watts×hours/pounds)/hours = watts×hours/pounds ×hours=watts/pounds, *i.e.*, watts discharge per pound, which cuts time out entirely!

A very lightly formed Planté plate lead cell with almost no acid space would give excellent results on this basis, which is suitable for a dynamo or an engine, but absurd for an *accumulator.*

I await the figures "watt *hours* per pound" with interest. It is to be hoped that the figures will be reasonably high, because we do need an improved high discharge rate battery to help us with electric vehicle and starter work.

W. Fennell.

Northwich, Ches.

Over-heating of a Fly-wheel Motor.

Owing to the divergence of views expressed with regard to trouble with a large motor, I would be glad to know the experience of other engineers in this matter. The motor is of the ordinary induction type controlled by a line switch and a liquid starter in the rotor circuit designed for 12½, 10, and 7½ per cent. slip; we are running at present on 7½ per cent. slip. Particulars of the motor are: 1,000 h.p., 3-phase, 50~, 2,200 V, 150/132 r.p.m., rotor volts 680. The motor is driving a large mill with three flywheels, and slows down on peak load, thereby allowing the flywheels to take the peak. Overheating takes place and the yoke becomes distorted. Rubbing took place, but we have overcome this by setting the rotor when the machine was hot. What effect would varying the slip resistance have on the power factor, and the heating of the motor?

We also have another trouble due to flashing over at the slip rings on starting up. We have tried to eliminate this by studying the conditions of the motor on starting, by varying the solution in the starter, by a thorough cleaning of slip rings and by making sure of a very good insulation test.

R.Y.

November 3rd, 1930.

Electrical Hop Drying.

Further to my letter about hop drying, I do not feel that I can let your comments pass without some defence of our procedure in this matter. You commended us for our enterprise in looking for new business, and at the same time criticised our obtuseness in applying an electrical method to existing apparatus. These criticisms are endorsed by Mr. R. Borlase Matthews in your last issue.

Strangely enough this aspect of the case did occur to us, and we were very loath to apply electric heating to a building which obviously was not the best thing for our purpose. Previous experience had, however, satisfied me that, if one sets out to get the most desirable arrangement, one often ends by getting nothing, and that it is much better to aim at something that one is likely to get. I am so satisfied that this is the best course that I would urge anyone looking for a new market for electricity to bring about the change with as little alteration as possible to the customer's apparatus. Improvements in efficiency will come at the suggestion of the customer, but, if one tries to put up what may obviously be the best job in the first instance, the whole scheme generally falls through.

Let me give you one or two instances of actual experience on this point. Several years ago one of my clients, who was in charge of water pumping with antiquated pumps down a well, worked by rods from shafting driven by a suction-gas engine, approached me about the possibility of using electricity. Obviously the right thing to do was to install vertical motors with centrifugal pumps down the well, and a pumping expert whose advice I obtained strongly recommended this course. The result was an estimated expenditure of £1,000, and our client put in an oil engine for £300 to £400, and I lost the pumping for a space of three or four years. After that period he had some trouble with the oil engine and, having learnt by experience, I hired him a motor without any capital outlay on his part and he is now driving his old pumps by electricity with a belt; doubtless in the near future, having satisfied himself that electricity is a good thing, he will of his own accord come to the installation which was suggested in the first instance.

The second case is that of a man with an enamelling oven who is anxious to try electricity. He is at present using a gas oven, which is not really suitable for electric heating; a proper electric oven will cost him £200 or £300, and he will certainly not go to this expense for what is to him an untried method. Therefore, at a cost of from £10 to £15 I am converting his gas oven to electric, and when I have satisfied him that it can be done he will doubtless be in a better frame of mind to think about a better article. In the meantime I shall be getting revenue from the current supplied.

The same remarks apply to the hop drying. Our client is now satisfied that it can be done, and is sufficiently interested in the method to consider better apparatus in which to apply electricity.

The moral of this is that the man who jumps for the top step sometimes gets there, but more often comes to grief, and it is just as well to see if there is a bottom step.

H. Wilson.

Ashford, *November 10th*, 1930.

British Motor Prices.

The following comparative prices of engines and an electric motor may be of interest to your readers. These are all net trade prices, and of standard British manufacture :—

3-h.p. petrol engine, complete with pulley and tank, running at 600 r.p.m. Price £22.

3-h.p. gas engine, complete with pulley and tank, running at 650 r.p.m. Price £34.

3-h.p. three-phase, squirrel-cage motor, complete with pulley, running at 950 r.p.m. Price £6 18s. 6d.

Is it not time the British manufacturers of electric motors got together with a view to charging prices having some relation of the cost of competitive prime-movers? At the present ridiculously low level of prices there is no profit either for the manufacturer, agent or contractor.

E. P. Allam & Co., Ltd.

London, W.C.1, *November 10th*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

11,671. "Coin-controlled electrically-driven apparatus." Alder & Mackay, Ltd., and J. Anderson. April 15th, 1929. (336,578.)

15,190. "Electric condensers." British Thomson-Houston Co., Ltd. (General Electric Co.). May 15th, 1929. (336,579.)

17,995. "Electric switches." Simplex Conduits, Ltd., H. F. McLoughlin, and F. W. Osborne June 12th, 1929. (336,558.)

18,141. "Construction of boxes or cases such as used for containing electric switches, fuses, and the like." J. A. Crabtree. June 13th, 1929. (336,618.)

18,725. "Radio-signalling apparatus for aeroplane landing places." C. Lorenz Akt. Ges. March 13th, 1929. (336,643.)

20,596. "Commutation of continuous current." Akt. Ges. Brown, Boveri et Cie. July 5th, 1928. (314,962.)

20,928. "Wireless systems for use in mobile stations." Graham Amplion, Ltd., and A. D'A. Hodgson. July 8th, 1929. (336,562.)

20,959. "Electric discharge apparatus for rectifying alternating currents." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 8th, 1929. (336,563.)

20,965. "Electric locomotives, tramcars, or other electrically-propelled vehicles." A. Tustin and Associated Electrical Industries, Ltd. July 8th, 1929. (336,564.)

21,349. "Electric switches." Graham Amplion, Ltd., and G. Holdway. July 11th, 1929. (336,568.)

21,556. "Automatic switches as used in telephone systems." Automatic Telephone Manufacturing Co., Ltd., T. C. Jordan, and S. G. Eddows. July 12th, 1929. (336,571.)

21,557. "Electric signalling systems." Automatic Telephone Manufacturing Co., Ltd., and G. A. Burns. July 12th, 1929. (336,572.)

21,568. "Process for the generation of intense photo-electric currents." G. B. Ellis (Soc. des Usines Chimiques Rhône-Poulenc). July 12th, 1929. (336,574.)

21,592. "Electric switches." J. S. Burns. July 13th, 1929. (336,575.)

21,618. "Electrical contacts." British Thomson-Houston Co., Ltd., and H. Trencham. July 13th, 1929. (336,577.)

21,687. "Electrical sound-reproducing instruments." H. E. Holman. July 15th, 1929. (336,648.)

21,693. "Wireless or like systems and apparatus." F. S. Barton. July 15th, 1929. (336,650.)

21,721. "Means for obtaining selective reception of radio and like signals." M. Von Ardenne. July 14th, 1928. (315,663.)

21,777. "Telephone pay stations." Associated Telephone and Telegraph Co. July 26th, 1928. (316,261.)

21,829. "Electric contacts." C. R. Cook. July 16th, 1929. (336,612.)

21,876. "Anodes for electric discharge tubes." British Thomson-Houston Co., Ltd. July 16th, 1928. (315,720.)

21,953. "Radio-telegraph receiving systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). July 17th, 1929. (336,625.)

21,954. "Loaded electric signalling cables." Standard Telephones and Cables, Ltd., and T. N. Riley. July 17th, 1929. (336,626.)

21,955. "Telephone systems." Standard Telephones and Cables, Ltd. (C. E. Stevens and A. Manor). July 17th, 1929. (336,627.)

21,957. "Vehicle electric lamps." J. Lucas, Ltd., and W. H. Eggington. July 17th, 1929. (336,628.)

21,984. "Gasfilled electric discharge illuminating tubes." F. Rother. July 18th, 1928. (315,794.)

21,994. "System of modulating high-frequency currents of thermionic tube generators." L. Mandelstam and N. Papalexi. July 17th, 1929. (Addition to 277,390.) (336,630.)

21,996. "Signal-controlled alarm devices." Telefunken Ges. für Drahtlose Telegraphie. August 6th, 1928. (316,934.)

22,004. "Synchronising means for television apparatus or the like." J. L. Baird. July 17th, 1929. (Cognate applications, 27,956/29 and 35,462/29.) (336,655.)

22,062. "Electric couplings of electrically-propelled trains." General Electric Co., Ltd., E. H. Croft, and A. C. Price. July 18th, 1929. (336,660.)

22,145. "Connector for securing branch wires to electric cables." A. H. Moorhouse. July 18th, 1929. (336,664.)

22,161. "Running light signs." A. White (C. Neon Lights, Inc.). July 18th, 1929. (336,665.)

23,085. "Trunk cables with balancing condensers." Siemens-Schuckertwerke Akt. Ges. August 3rd, 1928. (316,874.)

23,812. "Thermionic commutating and the like devices for use in multiplex signalling and for other purposes." Marconi's Wireless Telegraph Co., Ltd. September 29th, 1928. (Addition to 300,509.) (319,758.)

23,931. "Combined sound and picture film reproduction." Selenophon Licht- und Ton-Bildges. July 4th, 1929. (336,699.)

24,827. "Thermionic cathodes." E. Y. Robinson and Associated Electrical Industries, Ltd. August 14th, 1929. (Addition to 320,866.) (336,710.)

24,924. "System of the automatic illumination of aerodromes, motor ways and highways." S. Sanchez. February 28th, 1929. (336,712.)

25,091. "Electric signal transmission systems." Siemens & Halske Akt. Ges. August 25th, 1928. (317,852.)

25,271. "Electric supply arrangements." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 19th, 1929. (336,716.)

25,624. "Multi-frequency generators or transmitters." Telefunken Ges. für Drahtlose Telegraphie. October 1st, 1928. (336,721.)

26,075. "X-ray tubes." H. Seabrook (C. H. F. Muller Akt. Ges.). August 27th, 1929. (336,726.)

26,633. "Means for connecting pipes, electric immersion heaters, and similar apparatus to cisterns, tanks, and the like." A. B. Coleman. September 3rd, 1929. (336,735.)

26,740. "Ignition apparatus for internal-combustion engines." British Thomson-Houston Co., Ltd., and E. G. Parrott. September 3rd, 1929. (336,736.)

28,001. "Circuit arrangements for thermionic devices." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 14th, 1929. (336,746.)

29,290. "Synchronising apparatus for television and picture transmitting purposes." Telehor Akt. Ges. August 29th, 1929. (336,765.)

29,629. "Voltage regulators and the like." Marconi's Wireless Telegraph Co., Ltd. October 2nd, 1928. (336,771.)

30,183. "Signalling apparatus for controlling road traffic." L. C. Boisen. October 4th, 1929. (336,778.)

30,914. "Trunk cable with compensating condensers." Siemens-Schuckertwerke Akt. Ges. October 20th, 1928. (Addition to 316,874.) (30,994. See 23,880/29.) (336,784.)

31,087. "Electrically-operated signs of the monogrammic type." C. C. Henkes. October 14th, 1929. (336,786.)

31,906. "Telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman October 21st, 1929 (336,802.)

33,275. "Electric transformers." International General Electric Co., Inc. November 1st, 1928. (336,817.)

34,278. "Electric switching devices." J. H. W. Lewis. November 9th, 1929. (336,831.)

35,672. "Electrically-operated time fuses." Rheinische Metallwaaren und Maschinenfabrik. November 29th, 1928. (336,844.)

35,790. "Generator for extremely short electric waves." Telefunken Ges. für Drahtlose Telegraphie and W. Ludenia. November 22nd, 1928. (336,845.)

35,791. "Receiving device for extremely short electric waves." Telefunken Ges. für Drahtlose Telegraphie and W. Ludenia. November 22nd, 1928. (336,846.)

37,715. "Electric transformers." International General Electric Co., Inc. December 22nd, 1928. (Addition to 336,817.) (336,862.)

38,037. "Devices for preventing sparking at switching contacts, particularly high-tension contacts." C. Lorenz Akt. Ges. December 21st, 1928. (336,866.)

38,291. "Apparatus for the production of alternating currents for driving synchronous motors, more particularly for use in connection with picture transmission, television, and talking pictures." Telehor Akt. Ges. December 13th, 1928. (336,868.)

1930.

1,432/3. "Cores for electric transformers." J. W. Swendsen. January 16th, 1929. (336,890/1.)

1,580. "Electric condensers." British Thomson-Houston Co., Ltd. January 16th, 1929. (336,892.)

2,576. "Electric transformers." International General Electric Co., Inc. January 25th, 1929. (Addition to 336,817.) (336,901.)

4,227. "Making X-ray photographs." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 20th, 1929. (336,918.)

11,360. "Electromagnetic units for acoustic instruments." J. Rupert. April 10th, 1930. (336,930.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 5th :—

Turbloc. Nos. 515,341, 515,342, and 515,343. All goods in Classes 6, 13, and 17, respectively.—Brown, Boveri et Cie., Baden, Switzerland. (British representatives : Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

The Eye of the World (lettering and design). No. 512,089. Class 8. Apparatus for use in transmitting images, scenes, and sounds to a distance by electric telegraphy or telephony.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Barcol (lettering and design). No. 513,893. Class 8. Flashlight signalling apparatus, electric traffic signals, and automatic electric traffic controllers.—Barber & Colman, Ltd., Marshland Road, Brooklands, Manchester.

Orbit. No. 514,807 Class 8. Radio-telephonic and telegraphic apparatus and parts thereof, sound-reproducing apparatus and radio apparatus in combination with gramophones.—Catesby's, Ltd., 64-67, Tottenham Court Road, W.1.

Le Mikado. No. 515,123. Class 8. Electrical condensers and resistances.—Etablissements Langlade & Picard, Montrouge, France. (British representatives : Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Rayette (lettering and design). No. 515,277. Class 8. Dry batteries (not for medical purposes).—L. S. Weisman, 128, King Street, Hammersmith, W.6.)

Decca (lettering and design). No. 515,657. Class 8. Radio-telephonic and other signalling apparatus and instruments and parts thereof, &c.—Decca Record Co., Ltd., 1-3, Brixton Road, S.W.9.

Westone. No. 516,074. Class 8. Projection screens for kinematographs and the like.—Western Electric Co., Ltd., Bush House, Aldwych, W.C.2.

Kanden-Ar-Sun by Dr Mathiesen. No. 511,801. Class 11. Arc lamps and parts thereof for curative purposes.—Korting & Mathiesen Gesellschaft, Leipzig. (British representatives : Mathys & Squire, 52, Chancery Lane, W.C.2.)

Opalux. No. 515,628. Class 13. Electric lamps (ordinary).—British Electric Lamps, Ltd., Spencer Hill Road, Wimbledon, S.W.19.

Tediazed. No. 515,944. All goods in Class 13.—Siemens-Schuckertwerke Gesellschaft, Berlin. (British representatives : Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Concordia. No. 516,232. Class 13. Electric lamps (ordinary).—Thor Lamps and Supplies, Ltd., Tredegar Street, Cardiff.

Aldur. No. 514,593. Class 50. Moulding powders made of synthetic resin.—Aldur Corporation, Brooklyn, N.Y. (British representatives : Haseltine, Lake and Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Coal-analysis Specification.

The British Engineering Standards Association, 28, Victoria Street, Westminster, S.W.1, has sent us a copy of the draft British Standard Specification for the Sampling and Analysis of Coal for Inland Purposes [CC(CO)1778]. The draft has been tentatively approved by the Technical Committee for circulation to interested authorities for criticism, which will be welcomed by the committee responsible for its preparation. We hope to publish a critical review of the specification in the near future.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ANGLESEY.—Secondary school, Amlwch; secretary of the E.C.

ASHTON-UNDER-LYNE.—Senior school (£22,896) for the borough E.C.; education architect.

BERWICK.—Catholic school; priest-in-charge, R.C. church.

BEXHILL-ON-SEA.—Houses, Haddocks Hill and Jameson Road; J. E. Maynard, Collington Avenue.

BIRMINGHAM.—Extensions, Winson Green mental hospital; A. Grove, quantity surveyor, 10, Berkley Street, Broad Street.

BISHOPS STORTFORD.—Enlargement, poor law institution (£35,926); Herts. county architect.

BRIDLINGTON.—Municipal offices (£35,000); R. M. Newton, architect, borough surveyor's department.

BRISTOL.—School, Sea Mills (£11,530); H. C. Wakefield and Sons.

BROMBOROUGH.—Factory extensions; Planters' Foods, Ltd.

CHELTENHAM.—Houses (63), Folly Lane Estate, for the T.C.; Wheeler & Mansell, builders, Evesham.

CHESTER.—Extension of sewage disposal works; C. Greenwood, city engineer.

CHESTER-LE-STREET.—Houses (50); surveyor to U.D.C.

CHESTERFIELD.—Premises, Burlington Street, for Montague Burton, Ltd., Hunslet Road Mills, Leeds; H. Wilson, architect, 81, North Lane, Roundhey, Leeds. Shops and offices, Broad Pavement; R. J. Stokes & Co., Ltd.

CHURCH (Lancs.).—County branch library; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

COVENTRY.—Extensions, motor-'bus garage with installation of electric lighting, for the T.C.; T. R. Whitehead, general manager, Transport Department, Harnall Lane East.

DEAL.—Houses (50), Mill Hill Estate, for Snowdown and Betteshanger Tenants, Ltd.

DERBY.—Houses (1,000) for the T.C.; borough surveyor.

DEWSBURY.—Houses (60) for the T.C.; borough surveyor.

DONCASTER.—Houses (278), Intake Estate, for the T.C.; borough surveyor.

DURHAM.—School, Esh Winning, for the county E.C.; F. Willey, architect, 34, Old Elvet.

ERITH.—School (800 places) for the E.C.; clerk. Council offices for the U.D.C.; surveyor.

FINEDON (Northants.).—Houses (50) for the U.D.C.; surveyor.

GILLINGHAM (Kent).—Houses (170) with electrical work; C. J. Howard, Court Lodge.

HASLINGDEN.—Covered market; borough surveyor.

HEBDEN BRIDGE.—Baths; surveyor to U.D.C.

HERTS.—Schools, Barnet (£16,500), East Barnet (£13,500), Bushey, and Knebworth, for the county E.C.

HILLINGDON.—Casual wards (£19,000); Middlesex Public Assistance Committee.

HULL.—Shops and offices for Shell-Mex, Ltd., New Street (£46,970); R. G. Tarran.

INVERNESS.—New block and operating theatre at hospital (£12,000); A. Mackenzie, burgh surveyor.

IRISH FREE STATE (Dublin).—Shops, Inchinore, for Great Southern Railways; chief engineer, Westland Row station.

KENT.—School extensions, Chatham (£18,568); W. F. Blay, Ltd., contractors.

KETTERING.—Shops, showroom and house, Montagu Street and Thorngate Street, for E. Ward (Wellingborough), Ltd.; Talbot Brown & Fisher, architects, Bury Street, Wellingborough.

LEEDS.—Housing scheme (41 acres), Sandford Estate; city architect. Enlargement of Mount St. Mary's R.C. school (240 places); rector.

LETCHWORTH.—Extensions, Westbury School (£12,452); G. R. King, Northampton.

LONDON (Ilford, E.).—Houses (86), Tylehurst Gardens; T. B. Godwin, Ltd.

(Hampstead, N.W.).—Extensions, Queen Mary's Maternity Home; J. Seeley & P. Paget.

(Eltham, S.E.).—Bank, High Street; Elcock & Sutcliffe. Covered market, Elm Terrace; Woolwich borough engineer. School, housing estate (3,000 places), for London E.C.

(Lewisham, S.E.).—Church, Brockley Grove; Wm. Harbrow, Ltd. Theatre, Slaithwaite Road; J. Stanley Beard and Clare.

(Penge, S.E.).—School, Croydon Road, for the E.C.; clerk.

(Hammersmith, W.).—Tenements, Waterloo Street (£17,000); borough engineer.

LONGBENTON.—Houses (62) for U.D.C.; J. W. Braithwaite, builders, Heaton.

LYDNEY (Glos.).—Church, Primrose Hill; Ellery Anderson, architect, Cheltenham.

MACCLESFIELD.—Senior school, with electrical work, for the borough E.C.; director of education.

MANCHESTER.—Nursery school and domestic science centre, Ancoats (£18,000); director of education, Education Offices, Deansgate.

MANSFIELD.—Converting Sweetville House to police court (£19,740); Notts. Standing Joint Committee.

MIDDLESEX.—New schools, Feltham (500 places), Kenton (800 places), and enlargement of Western Road School, Southall, for the county E.C.

MIDDLETON.—Schools, Alkington and Boarshaw (£35,000); secretary to the E.C.

MOTHERWELL.—School, Hamilton Street; Executive Officer to the Education Authority.

NANTWICH.—Bank, High Street, for the National Provincial Bank, Ltd., London. Public baths for the U.D.C.; surveyor.

NEWCASTLE.—Extensions, factory premises, Scotswood Road; G. M. Carter, architect, Carlton House, Jesmond Road.

PLYMOUTH.—Houses (52), Molesworth Road, Stoke; St. Aubyn Estates, Ltd. Cinema, Frankfort Street; Regent Cinema (Portsmouth), Ltd. Hospital, Mount Gould (£43,885); borough engineer.

RIPON.—Bank, Market Place and Kirkgate; Westminster Bank, Ltd.

RUGELEY (Staffs.).—Houses (60) for the U.D.C.; C. Mason and Sons, builders.

ST. ALBANS.—Mental colony, Cell Barnes; Herts. C.C.

SHEFFIELD.—Houses (54), Greenhill Estate (£20,790); city architect.

STAFFS.—Schools, Pensnett (£20,320), Shelfield, Sedgeley, Willenhall, Bushbury, Tamworth, Tettenhall, and Upper Penn, for the county E.C.; director of education, Stafford.

STOCKTON-ON-TEES.—Municipal offices for the T.C.; Lanchester & Lodge, architects.

STRANRAER.—School (£14,000); master of works, E.C., Newton-Stewart.

TENDRING (Essex).—Houses (100) for the R.D.C.; surveyor.

TIPTON.—Housing scheme (£40,000) for the U.D.C.; surveyor. Senior school (£35,300) for the E.C.; director of education.

TORQUAY.—Schools, Babbacombe (£50,000) and Torville, for the borough E.C.; director of education.

TWICKENHAM.—Ward extensions at St. John's Hospital; Brewer, Smith & Brewer, architects, Richmond.

WATFORD.—Enlargement, poor law institution (£14,500); Herts. Public Assistance Committee.

WEDNESBURY.—School for the E.C.; education architect.

WEST RIDING.—Electric lighting installation at Sprotborough schools for county E.C.; A. J. Dempster, divisional clerk, Winchester House, Scot Lane, Doncaster.

WOLVERHAMPTON.—Houses (52) for the T.C.; Eadie, Towers, & Co., builders.

WORKSOP.—School, Manton (£11,177); Greenwoods (Mansfield), Ltd.